AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 8, No. 15. WEEKLY. | NEW YORK, APRIL 11, 1885. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

COPYRIGHT, 1885, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers. ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

New Heavy Milling Machine.

The machine illustrated herewith is adapted for tool and engine builders. It has reversible automatic feeds in every direction, with adjustable stops, swivel table, and four-inch steel bar to support cutter arbors.

The base of the machine is 60″x39″, and the spindle, $3\frac{7}{8}$″ diameter, stands at a height of $52\frac{1}{2}$″ from floor. The spindle has a hole through it $1\frac{5}{16}$″ diameter, the large end of taper in end being 2″.

The machine is back geared 8 to 1; spindle at slowest speed making $6\frac{1}{2}$, and at fastest 188 revolutions to 100 of countershaft.

The diameter of largest cone is 16″, for 4″ belt.

The face of column is 16″ wide by 42″ long, the knee having a bearing on column 30″ long. The top slide of knee is 16″ wide.

The feed table is 54″ long and 14″ wide, with side bearing 18″ long, and swivel base 16″ diameter. The knee has a vertical movement of 20″, and the slide has a movement on knee, parallel with spindle, of 12″. The longitudinal movement of table is 40″. The machine has four changes of feed.

Of the attachments for machine the vertical attachment for vertical milling, profiling, rack cutting, etc., has two spindles at right angles to the main spindle, and is secured by four bolts to the front of the head. It can be set at any angle from vertical to horizontal. Distance from center of spindle to the back, 12 inches. Diameter of spindle, 2 inches. Hole in spindle, $1\frac{1}{4}$ inches. There is a supplemental spindle for cutting-racks.

The vise has a length of jaws 8 inches, depth 2 inches, amount of opening $5\frac{1}{2}$ inches, and is adapted to swing from a horizontal to a vertical plane and at any angle therein.

A circular chuck for clamping work consists of two indexed plates, the bottom having a tongue which fits the T-slots of the sliding-table, and the top having T-slots and a central stud for holding work.

Two facing heads or rotary cutters are 6″ and 12″ diameter, with 12″ and 20″ cutters.

The boring head is 4 inches diameter. The rotary cutters and boring head are adapted to screw on to the main spindle.

The manufacturers of this machine are Detrick & Harvey, Baltimore, Md.

European legislators are not generally so patient with steam users who stifle their neighbors with clouds of black smoke as our law makers are, and the rule abroad is to find very stringent laws against smoke raising. Laws are not, however, always effective, and in some towns there is as much smoke to complain of as there is in Pittsburgh aud Chicago. When the owner of a boiler or furnace complies with certain regulations respecting smoke preventing apparatus he complies with the requirements of the laws and makes the statutes responsible for any smoke he may raise. Where inferior firemen are employed it is found that the laws have to bear the responsibility for a very severe smoke nuisance. There is now a movement abroad looking towards including the necessity for employing skillful firemen as part of smoke preventing ordnances.

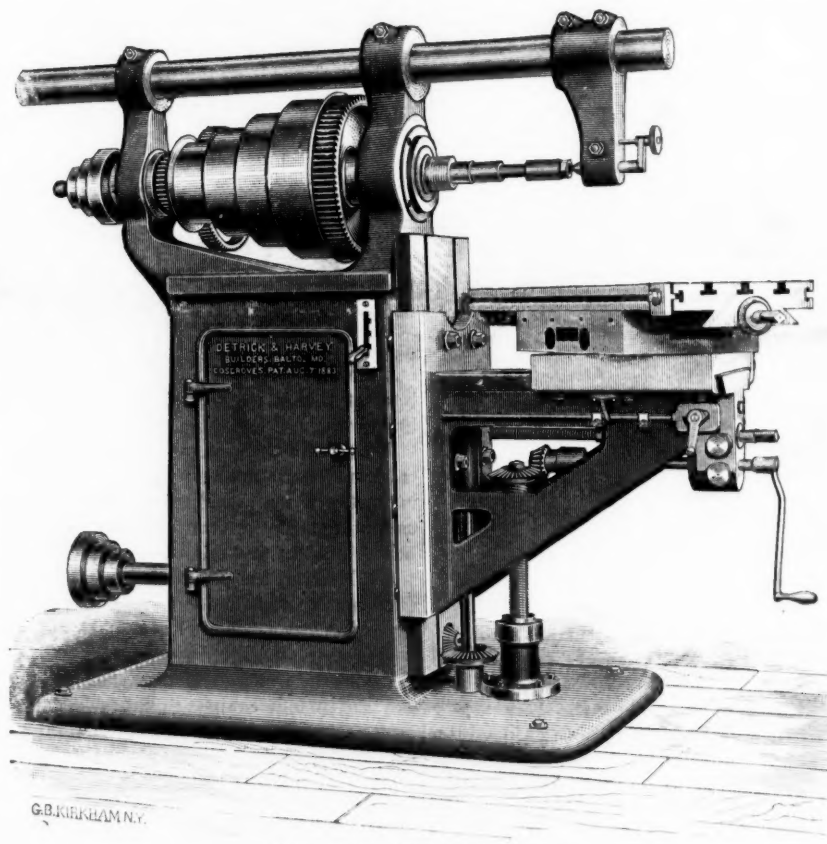
Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

THIRTEENTH PAPER.

Early in the year 1834 the entire line of the Pennsylvania mongrel improvements, part canal and part railroad, between Philadelphia and Pittsburgh, was opened for freight and passengers, and worked, with the exception of steam on its inclined planes, by horse or mule-power. The small four-wheel freight cars, limited as to capacity and load, not to exceed three tons per car, were mostly owned by individuals or firms who also owned the canal-boats and horses. The road was built for and used as a public highway, charging toll.

It was not long before breaking bulk at Columbia, reloading from the cars into the canal-boats, and again at Hollidaysburg from the canal-boats on to cars, and, after passing over the portage, or Mountain Railroad, division to Johnstown, again transferring to canal-boats, with the damage from handling certain kinds of freight, and greatly increased cost of transportation on all classes of freight, was a state of things that called mechanical ingenuity into play. The first success was in making the box or car body independent of the trucks, so arranged as to be easily and securely attached or disengaged, and the building of open canal-boats with low-down decks. On the arrival of the cars at Columbia the box bodies were loosened from the trucks, and, together with their freight, hoisted by cranes, swung over and deposited on the low-down decks of the canal-boats; and again, in the same manner, transferred from the boats to trucks at Hollidaysburg, and, after crossing the portage to Johnstown, again into canal-boats.



NEW HEAVY MILLING MACHINE.

The system of the portage railroad consisted of ten inclined planes and eleven levels —the height overcome in the ten miles between Hollidaysburg and the summit tunnel being 1,339 feet, and the descent to Johnstown, in $26\frac{1}{2}$ miles, 1,171 feet. This entire work was constructed in the most permanent and best possible manner known at the time. The double-track incline planes were heavy wooden stringers, secured to stone foundations, and laid with flat bar rails. The levels between the incline planes were laid with what was then called the Stevens T rail of about 40 lbs. per yard, keyed into cast-iron chairs, which were bolted to sandstone crossties, alternating with sandstone blocks. These stone blocks did not extend under both rails, as the cross-tie stones did; they were about 12 inches deep, and had a base equal to about 20″ x 24″; the chairs were set three feet apart. All the masonry of the road was of the finest and most substantial character. The Conemaugh Viaduct, which, I believe, is still in use by the Pennsylvania Railroad Company, was a great point of attraction to engineers as well as to travelers.

As to the steam engines and machinery of the incline planes, the fact that they were in use for about twenty years, and frequently taxed to their utmost capacity without a serious accident, fully attests the completeness of the plans, care in their construction, and use. Hemp ropes were used on the inclines, it being before the day of wire ropes. The usual number of cars drawn up the inclines, while the same counter-balancing number was being let down, was four of these small four-wheel box cars, which were then taken from the head of one incline plane to the foot of the next, or *vice versa*, by horse-power. At the time the portage railroad was under construction, it was a subject of much discussion among all classes, and the general opinion was that it would prove a failure. Sylvester Welch, the father of the scheme, and chief engineer in its location and construction, was often sorely beset by influence brought to bear on the canal commissioners, and even after exhaustive surveys had been made and the route located, still other surveys were ordered with a vain hope of finding a practicable route without the inclined planes, with gradients not to exceed 40 ft. per mile, that being the extreme limit then thought practical to work with safety even with horse-power by doubling teams. In later years when Mr. Welch was engaged on the Covington & Lexington Railroad, of Kentucky, he used to relate the difficulty he had to satisfy the canal commissioners that his system of inclined planes and levels was no complication, as they conceived it to be, to persuade them to allow the work to go on. They admitted the simplicity and effectiveness of the Peter's Island incline plane on the Columbia road, yet feared his on account of what they termed its complication, when he insisted that in fact it was but a repetition of simplicity.

The fact that my schoolmates and most intimate friends were the chief assistants of Mr. Welch, made me take great interest in the progress of the surveys and work, concerning which I was kept constantly posted. William Milnor Roberts had charge of the division from Hollidaysburg to the Summit, and the work on the east end of the great Alleghany tunnel, and Solomon W. Roberts of the west end, and the work from there to Johnstown; and Edward Miller had charge of the machinery of the incline plane. No engineers are better known by their life-long works than S. W. and W. Milnor Roberts, who though of the same name were of no blood relationship. W. Milnor's life was sacrificed to his profession in South America at so recent a date that most engineers must be familiar with the circumstances of his undertaking the great South American works at his advanced age, under a binding contract for four years, service.

Although most of my life has been devoted to mechanical engineering, the intimacy with my early civil engineer friends was always kept up; and at the frequent meetings with both of the Roberts, the subject of their first work, the *Old Portage* was never tiring, and it is from these reminiscences that I have drawn more of what I have written on the Old Portage than from my own observation, as I only visited it twice during the time the Roberts were on it. On one of these occasions W. Milnor Roberts referred to the great trouble he had in the effort to substitute locomotive power for horses on the levels between the inclines. The Portage had not been operated over one year, when a locomotive built in Boston was received. At that time moving grain in bulk to the Eastern markets had not been conceived of; it was all racked, loaded into canal boats at Pittsburgh, and at Johnstown it and other heavy freight such as flour, pork and whiskey in barrels, was transferred on open four-wheel platform cars and covered with canvas or tarpaulins. The sparks thrown from this wood-burning Boston locomotive set fire to the canvas covers, and necessitated carrying a man with broom and buckets of water to every two cars of the

train. The same kind of canvas-covered cars were also on the Columbia Road for the same class of freight, but as the wood burning locomotives came into use in place of the horse-power the canvas-covered cars had to be taken off. By the end of the second year all the eleven levels of the Portage were operated by locomotives.

The next expedient to save the expense and delays of breaking bulk and handling freight, was making canal boats in sections. This ingenious device answered a good purpose, notwithstanding the increased dead weight of the permanent cabins and water-soaked hulls, over the movable box-car that had to be hauled over the portage. At first they had to contend with great opposition and prejudice on the part of shippers of fine goods. Much was said at the time about damage caused by leakage of the square truncated ends of the boat sections in consequence of rocking and drying on the cars and opening of the caulked seams. This was, no doubt, greatly magnified by competing transportation firms. Any one who will take the trouble to look over the advertisements in files of Philadelphia and Pittsburgh papers, say from 1835, can form some idea of the rivalry between the different transportation firms or companies. The boat sections for freight going west were loaded in Philadelphia warehouses, hauled by horse-power to the foot of the Peter's Island incline; from the head of the plane they were mostly taken by locomotives to Columbia, for at the date of their advent locomotives had nearly if not quite supplanted horses on the Columbia or State road. In the published history of the Baldwin Locomotive works from 1831 to 1881 they give the date of the completion of their first engine for the State road as June 1834; it was fully a year before this that the Long & Norris engine was tried on that road, and if my recollection is not entirely at fault there were two Norris engines and two or three imported English engines working on the road in the fall of 1834. Floating the boat sections from their trucks into the canal basin at Columbia, bringing them together and uniting them into full canal boats, was always a sight of great interest to travelers, as was also their transfer to trucks at Hollidaysburgh.

For the traveling community the small coaches or cars seating from 20 to 26 passengers were a great improvement for comfort over the old stage coach; though destructive to the proverbial stage coach conviviality, but this was in a measure made up on the canal boat portion of the routes, where passengers were at ease with full liberty to walk about or lounge as they liked; groups were formed, games indulged in, and not unfrequently rival races on the tow path. As to the passenger canal boats they were a marvel of ingenuity in their arrangement for accommodation and comfort of the traveler; they might be termed the forerunners of the Pullman sleeper and dining car. Much was concentrated within their hulls and miniature cabin; comfortable, broad omnibus seats along the sides, with space between for camp stools, without greatly interfering with the passage; a long dining table was set, and fair meals furnished at reasonable rates for way passengers, those for the through passengers being included in the fare. At night rows of berths one above another along the sides of the cabin were arranged, a curtain separating the ladies' from the gentlemen's cabin, and all were intended to be and supposed to be made comfortable, and, barring mosquitoes at certain seasons, no one had a right to complain, as all these comforts were furnished without extra charge. The quiet gliding of the boat along the valley of the Susquehanna with its beautiful ever-changing scenery, and the wilder valley of the Juniata was very enjoyable. In fair weather, and moonlight nights, the roof or deck of the boat would be well covered with passengers, using their trunks for seats, but ever mindful of the call of "low bridge" from the helmsman, (and some of them went so low that the trunks on the roof barely cleared them as the boat passed under) the ducking and contortions of the passengers, sometimes throwing themselves flat on the roof, was always a source of amusement. On nearing the Portage all was excitement, particularly among those crossing for the first time; for the old portage or mountain crossing was one of the greatest wonders of the world in its day.

On the landing of the canal boat at Hollidaysburg, passengers would rush for the cars to secure the most favorable seats for seeing. Many of those crossing for the first time, and all the timid ones, while the cars were being fastened to the rope of the incline would make for the side walk and go up on foot; some would walk up the second incline, but by that time all would gain sufficient confidence to trust themselves to ride. On one occasion I was one of four to carry an invalid lady in a chair to the top of the first incline, and then to so surround her in the car that she had partly ascended the second before discovering it; then she was terror-stricken, and made a great effort to faint, but failed in the attempt, the mountain air being too exhilarating. She finally subsided, and I really believe enjoyed the rest of the passage, except the tunnel.

The estimated capacity of the incline planes was ten trains of four cars each way per hour. I have timed them when pressed to their utmost; unavoidable delays at the top for the descending, and at the bottom in making up the ascending trains, brought the average number of trips not to exceed 7 per hour. Mr. Miller thought that an excessive average for a length of time; though with everything favorable 10 had been accomplished in a single hour.

Several prominent engineers of England and France came to America for the express purpose of witnessing the working of the American Mountain Railway. I met with two of these, who both spoke of it as the grandest conception that had ever been ultimated. Even Charles Dickens, who on his first visit to America, crossed the Portage before it was superseded by the Pennsylvania graded road, although he was oblivious to the bevel-edged plate glass mirrors, and gorgeously new furnished and upholstered canal boats for his especial use, and that of his party, an old friend of mine, long since departed, who was one of the party, said that Dickens was, no doubt, bored by intruders on the route, but he showed more interest and animation on the Portage than at any time during his intercourse with him; that he could not say enough in praise of the boldness of the design, and the grandeur of the scenery, frequently recurring to it; but he disgusted one who had been prominent in embellishing the canal boats, and who lost no opportunity of calling his attention to them by saying, "Very nice, very nice, but rather stuff-bluffy and somewhat disagreeably odoriferous." Probably the fumes from the kitchen and the wine bins did not harmonize.

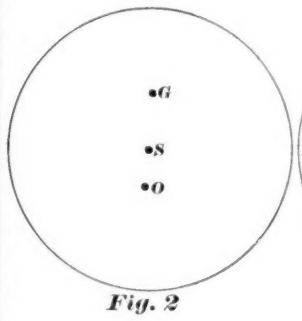


Fig. 2

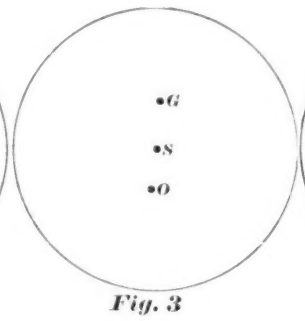


Fig. 3

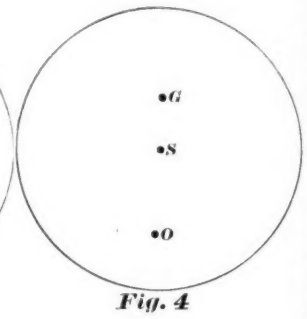


Fig. 4

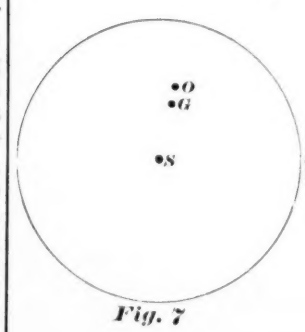


Fig. 7

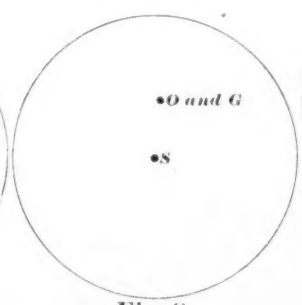


Fig. 8

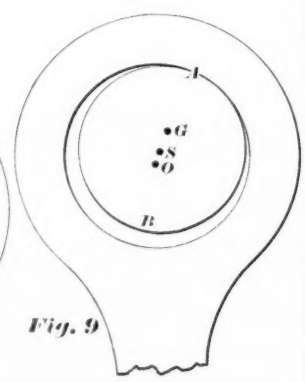


Fig. 9

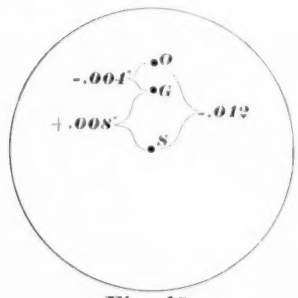


Fig. 10

The Balance of Rotary Parts of Machinery.

By John Coffin.

I did not intend to write again upon this subject, but the article by Mr. J. C. Hoadley has so charmed me that I cannot resist.

I did not elaborate on the subject before, for I thought few of your readers would be interested in it, but I think our friendly discussion on the subject has awakened so much interest that a mathematical analysis would be in order.

Though for the general reader mathematical formulæ are not very acceptable, yet this is purely a mathematical subject, and we cannot get at the core of it without some help from plus and minus.

Mr. Hoadley has given us the details of his experiment carefully, and the dimensions of his apparatus. I regret I cannot do the same in regard to mine.

About the Defiance Machine Works, I will say the machine they make for balancing pulleys is a good one. The pamphlet is, perhaps, a good advertisement; but when I read it my opinion was like Mr. Ball's, that as a treatise on the subject it was a failure. To satisfy myself that my conclusions were correct, I tried the experiment described in my letter in the American Machinist of January 17, 1885. I made no notes of the experiment, so I can only give the dimensions from memory.

The disk was slightly heavier than Mr. Hoadley's, and much more out of balance; the shaft was nearly twice as long, about the same size, and one end free, the other end being chucked. In starting on the fast speed, I steadied the shaft with my hand until the speed was reached.

I know Mr. Hoadley is too fair-minded to object if I criticise the conclusions he draws from his experiment. I don't think it was looseness in the centers that made the disk throw out more than his calculations called for. He calculates a certain excess of weight on one side of the axis of revolution, but we can see, as soon as the centrifugal force springs the shaft, the result is a greater excess of weight on that side, or, as the shaft springs, the factors of centrifugal force increase.

Let us reduce it to calculation. The weight of the disk and hub is, say, 3.5 lbs.; weight of unbalanced part, three inches from axis, $\frac{66}{7000}$ lbs.; center of gravity of unbalanced disk, .008 inch from center of shaft.

Let D represent deflection in inches.
" r " " radius "
" rev " " revolutions per minute.
" w " " weight in lbs.
" F " " centrifugal force in lbs.

.0000284 is the coefficient of centrifugal force when the radius is expressed in inches. Then

$$rev^2 \times r \times w \times 0000284 = F.$$

The deflections of a shaft of those dimensions are .00035 inch for each pound of force (we will hereafter, for convenience, call this expression deduced from any shaft coefficient of deflection).

So

$$D = .00035 \times F$$

and

$$\frac{D}{.00035} = F$$

hence

$$rev^2 \times r \times w \times .0000284 = \frac{D}{.00035}$$

r in this equation is an unknown quantity, and is equal to .008 + D. Substitute this value for r and numerical values, and we have

$$3760^2 \times (.008 + D) \times 3.5 \times .0000284 = \frac{D}{.00035}$$

reduce to

$$11.242 + 1405.25\,D = \frac{D}{.00035}$$

$$D = .0077 \text{ inches.}$$

Thus we see that the deflection of the shaft would be .0077; or, in ordinary parlance, the disk would run out twice that much, or .0154 inch. The center of gravity would describe a circle of .0157 inch radius. To generalize:

Let w = weight.
" v = revolutions.
" c = coefficient of centrifugal force.
" D = deflection of shaft.
" e = distance center of gravity is from center of shaft.
" d = coefficient of deflection.

Then

$$w v^2 (D + e) c = F = \frac{D}{d}$$

multiply by

$$\frac{d}{D + e}$$

Then

$$w v^2 d e = \frac{D}{D + e}$$

let

$$w d^2 d e = T$$

Then

$$T = \frac{D}{D + e}$$

Let us inspect this equation. T is always positive, for it is composed of positive factors when

$T = o$ ..... $D = o$ 1
$T < \frac{1}{2}$ ..... $D < e$ 2
$T = \frac{1}{2}$ ..... $D = e$. 3
$T > \frac{1}{2}$ ..... $D > e$ 4
$T < 1$ ..... D is + ... 5
$T = 1$ ..... $D = \infty$ 6
$T > 1$ ..... $D < -e$ 7
$T = 8$ ..... $D = -e$ 8

In expression 1, T can $= o$ only when the disk is in perfect balance or standing still.

In the figures, O is axis of revolution, S is center of shaft, and G is center of gravity; then O S in the figures = D in expressions, and S G in the figures = e in expressions.

The figures are numbered to correspond with the numbered expressions. No. 2 coincides with Mr. Hoadley's case, in which T is a trifle less than $\frac{1}{2}$, viz., .49184.

No comments are required on Nos. 3 or 4. No. 5 includes 2, 3 and 4. No. 6 is impossible, for the shaft would break before T = 1 could be reached. In No. 7 $D < -e$, that is considering e always positive. D is a negative quantity, greater numerically, than e, and is so represented in the figure, the center of gravity being between the shaft and axis of revolution. In No. 8 the limit is reached when $T = \infty$, and the axis of revolution passes through the center of gravity, which of course is not possible to quite attain.

We will now apply this general equation, *i. e.*, $T = \frac{D}{D + e}$ to practical problems.

In order to attain a velocity which would

give condition 7, *i. e.*, $D<-e$, we have to pass through condition 6, *i. e.*, $D=\infty$, which would break the shaft. How, then, we ask, is it possible, to reach condition 7? It is not possible to reach condition 7, where the coefficient of deflection is a constant quantity, with one possible exception which I have not analyzed very carefully, which is the case where the velocity is increasing or decreasing rapidly. I believe it may be possible to start a disk on a shaft quick enough to reach condition 7 without breaking the shaft.

A familiar example is the schoolboy's buzz on a string. If the buzz is out of ballance, it assumes condition 7, though sometimes "runs down" on condition 5, although in that case the coefficient of deflection is not constant, if it were not for the rapid increase in velocity and the resistance of the air, it could not assume condition 7.

We ask how, then, can an emery wheel assume condition 7 without breaking the shaft or frame? Owing to the looseness in the shaft, bolts, and other places, we can move the emery wheel a certain small amount without much pressure. During this movement the coefficient of deflection is a comparatively large number, but as soon as the limit of this movement is reached, we have a new coefficient of deflection, due to the strength of the whole machine, which is very much smaller than the first coefficient.

This last coefficient, introduced in the equation, keeps the deflection down until $T>1$, calculated by the first coefficient of deflection.

In other words, the rigidity of the machine holds it until it can handle the slack.

The question may be asked, when the second coefficient is involved, why are not both coefficients united in the form of their product, divided by their sum, to form a new coefficient?

They are.

Then how can the second coefficient be thrown out?

Referring to Figure 9, S represents the center of a shaft, which is loose in the box, as shown, A being its point of contact, O, its axis of revolution, and G its center of gravity. G is only slightly removed from S, so G represents the center of a very slow cam, of which the circumference of the shaft is the periphery, the friction with the box causes the contact spot, A, to revolve around the shaft to B, and brings a condition favorable to eliminating the second coefficient of deflection.

This is one reason why emery wheels assume condition 7; discordant vibrations in the frame, and connections also, tend to promote it.

But it cannot come about with a constant coefficient of deflection.

Let us see how Mr. Hoadley's experiment may be varied in order to bring about condition 7. We have seen in his experiment $T=\frac{1}{2}$, nearly, therefore, if we multiply any factor in T by 2, we will make $T=1$, or the exact point where condition 7 commences.

(Of course, we would go beyond this point in the experiment to have a safety factor, for unsteadied, we would pass a wrecking point both in starting and in stopping, and it would be pleasant to know that while our machine was running quietly, we were right on the edge of the precipice, as it were.)

To compute $T=1$, we will first change the revolution factor.

As that enters T in the form of a square, to multiply T by 2 we must multiply the revolutions by $\sqrt{2}$ $1.415\times3760=5320$.

Hence, at 5,320 revolutions per minute, it would assume condition 7, say 6,000, we would have a margin of safety, but as we don't want to run the disk so fast, let us change the factor, *d*, or coefficient of deflection. The diameter comes in inversely as a 4th power, so we must change the diameter as $\sqrt[4]{2}$: 1 in order to change T as 1 : 2, so

$$\frac{.5}{1.19}=.42,$$

the diameter of the shaft required to produce condition 7, but as the hub adds some to the stiffness of the shaft, and we wish an element of stability, suppose we make the shaft $\frac{5}{16}$ inch in diameter, then we have a factor of stability of about 3, or $T=3$, or $2D=-3e$, or D is negative and numerically $2D=3e$.

In this case $e=.008$, and Fig. 10 represents the condition. The center of gravity describes a circle whose radius is numerically .004, and the shaft is deflected numerically, .012, the center of gravity being between the axis and shaft.

To try this experiment in this form, I would put a rest-up in the form of a ring, encircling the shaft, but large enough so that at this velocity the shaft would have no contact with the ring. Suppose we make the ring just large enough so that the shaft would touch at the velocity $T=2$, when $T=2-D=2e$,

$$D=.016 \text{ in. } \ldots \; 2D=.032 \text{ in.},$$

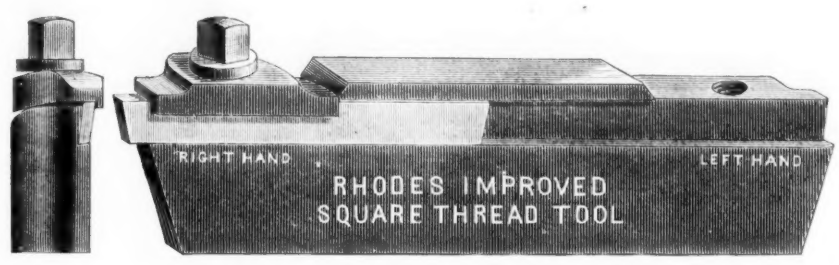
so I would make the ring about .032 inch larger than the shaft, and set it as near concentric as could be conveniently done.

I will cite a few cases, in which condition 7 takes place. Emery grinding and polishing wheels (it is well known to all polishers that the light side of the wheel runs out), threshing-machine cylinders, sometimes, burr millstones, circular saws, and other fast-running machinery, the school-boys' buzz, and the jugglers' plates.

In the latter case, the plate spinner is also aided by the gyroscopic principle.

I have gone over these figures carefully without finding an error, or conclusion that is not supported by practice. Yet I know we are all liable to err.

I invite careful criticism, and I hope any fallacies in my reasoning may be pointed out, and that our mutual work may establish some standard method of calculating the eccentricities of these little whirling masses.

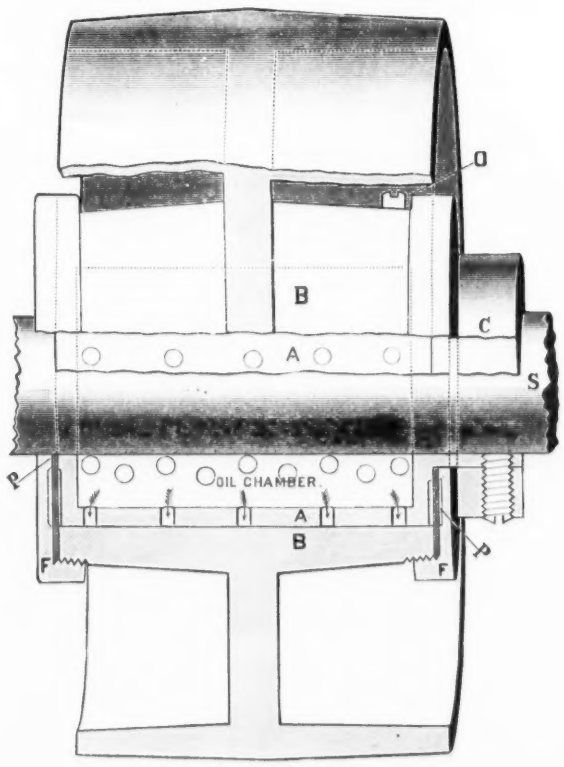


Threading Tool.

Horton's Self-Oiling Loose Pulley.

The engraving represents what appears to be an excellent loose pulley, the invention of James A. Horton, and manufactured by the Howard Metallic Brush Company, Boston, Mass.

In the engraving, *A* is a shell rigidly fastened to the shaft by means of the set screw represented at one end. The outside of this shell forms the bearing surface upon which the pulley runs. In the inside of this shell is a chamber for oil, which is filled through hole *O* by removing the plug. The ends of the hub of the pulley are threaded for the caps *F*. Leather packings, *P*, fitting the shaft, are forced by the caps *F* hard against the ends of the hub, preventing the escape of oil from the chamber. A series of holes, as shown, are provided, leading from the oil chamber to the outside of shell, through which the oil is carried by centrifugal force, thus bringing about the most thorough lubrication. The chamber in shell is made of sufficient size to hold oil enough, so that no attention to oiling is required for long intervals of time.



Loose Pulley.

Threading Tool for Square Threads.

The Hartford Tool Company, Hartford, Conn., have recently brought out a tool-holder and tools for cutting square threads, which must prove a convenience to those having much of this kind of work to do, as well as much cheaper than the ordinary practice in this respect. Square threads would undoubtedly be used more than they are but for the trouble and expense of cutting them.

The engraving needs but little in the way of explanation. Right-hand threads are cut with one end of holder forward, and by simply reversing holder and cutter left-hand threads may be cut.

The strap which clamps the cutter has an elongated hole, and adjusts itself to different widths of cutter, pressing the cutter against straight side of holder, and holding it rigidly in place. The cutters are concaved on the sides requiring clearance.

When nice work is required, a cutter one size smaller than that required for finishing can be used for roughing out.

Should a cutter require sharpening before the thread is finished, it can be taken out and ground without disturbing the holder; then, when replaced, it will be exactly right to resume its cut.

The holder is of a size to fit the ordinary tool-post.

Rules for Management and Care of Steam Boilers.

ADOPTED BY THE HEWES & PHILLIPS IRON WORKS, NEWARK, N. J.

1. Condition of Water.—The first duty of an engineer, when he enters his boiler room in the morning, is to ascertain how many gauges of water there are in his boilers. *Never unbank nor replenish the fires until this is done.* Accidents have occurred, and many boilers have been entirely ruined from neglect of this precaution.

2. Low Water.—In case of low water, immediately cover the fires with ashes, or, if no ashes are at hand, use *fresh coal.* Do not turn on the feed under any circumstance, nor tamper with or open the safety valve. Let the steam outlets remain as they are.

3. In Cases of Foaming.—Close throttle and keep closed long enough to show true level of water. If that level is sufficiently high, feeding and blowing will usually suffice to correct the evil. In cases of violent foaming, caused by dirty water, or change from salt to fresh, or *vice versa*, in addition to the action before stated check draft and cover fires with fresh coal.

4. Leaks.—When leaks are discovered they should be repaired as soon as possible.

5. Blowing Off.—Blow off 8 or 10 inches at least once a week; every Saturday night would be better. In case the feed becomes muddy, blow out 6 or 8 inches every day. Never blow entirely off except when boiler needs scraping or repairing, and then not until fire has been drawn for at least ten hours, as boilers are often seriously injured or ruined by being emptied when the walls are hot. Where surface blow cocks are used, they should be often opened for a few moments at a time.

6. Filling Up the Boiler.—After blowing down, *allow the boiler to become cool* before filling again. Cold water, pumped into hot boilers, is very injurious from sudden contraction.

7. Exterior of Boiler.—Care should be taken that no water comes in contact with the exterior of the boiler, either from leaky joints or other causes.

8. Removing Deposit and Sediment.—In tubular boilers the hand-holes should be often opened, and all collections removed from over the fire. Also, when boilers are fed in front and blown off through the same pipe, the collection of mud or sediment in the rear end should be often removed.

9. Safety Valves.—Raise the safety valves cautiously and frequently, as they are liable to become fast in their seats, and useless for the purpose intended.

10. Safety Valve and Pressure Gauge.—Should the gauge at any time indicate an excessive pressure, see that the safety valves are blowing off. In case of difference, notify the parties from whom the boiler was purchased.

11. Gauge Cocks, Glass Gauge.—Keep gauge cocks clear, and in constant use. Glass gauges should not be relied on altogether.

12. Blisters.—When a blister appears there must be no delay in having it carefully examined, and *trimmed*, or *patched*, as the case may require.

13. Clean Sheets.—Particular care should be taken to keep sheets and parts of boilers exposed to the fire perfectly clean, also all tubes, flues, and connections well swept. This is particularly necessary where wood or soft coal is used for fuel.

14. General Care of Boilers and Connections.—Under all circumstances keep the gauges, cocks, etc., clean and in good order, and things generally in and about the engine and boiler room in a neat condition.

A French engineer proposes a system of pneumatic transmission between Paris and London. He proposes to use two tubes, and to transmit parcels weighing as much as eleven pounds. He calculates that the time required for transmitting a parcel will be one hour. He is considerably more reasonable than the American inventor who proposed to accomplish the distance between New York and Chicago in the same time.

Compressed Air Pump.

Compressed air has come to be extensively used for motive power in mines, especially for operating pumps, when it is generally used in machines designed for the use of steam, and which were employed before the introduction of compressed air. The direct-acting steam pump, when operated with steam is under the circumstances economical, because at the slow piston speed that must prevail steam cannot be worked expansively in any great degree without complications that are advisable only in exceptionally large machines.

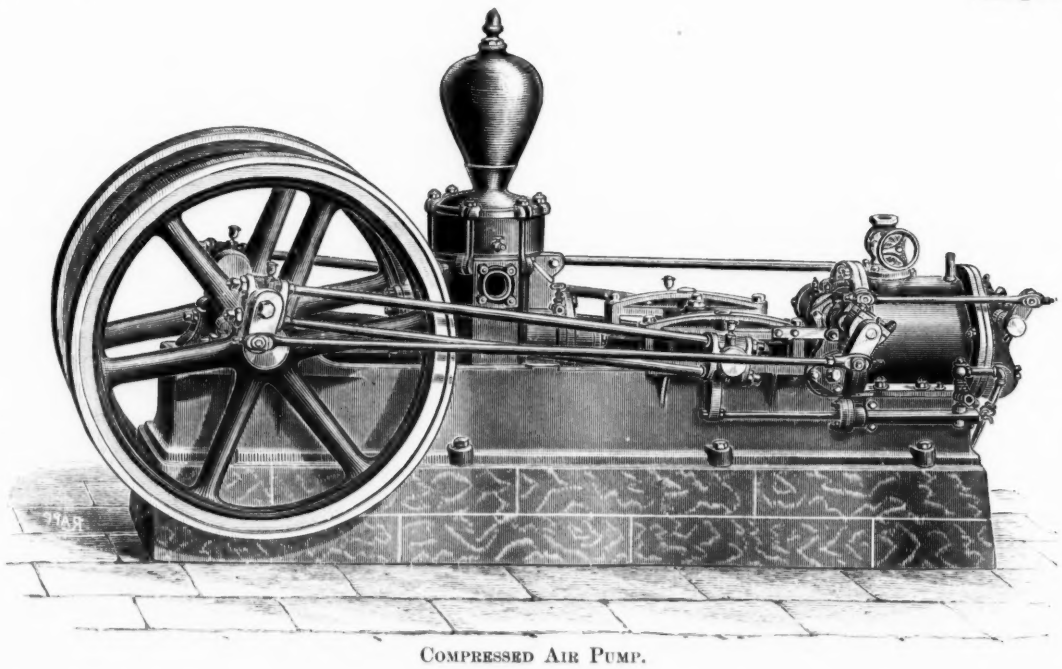
But with compressed air the conditions are quite different, and its economical use requires different construction. There is no condensation in the cylinder, and slow piston speed becomes an advantage instead of a disadvantage in working expansively. The air being admitted to the cylinder at the temperature of surrounding objects, rapidly cools in expanding, and any heat that may be added to it increases the power. That is, if the air is expanded without receiving heat the work performed by a given quantity is much less than if the heat is kept uniform. Slow piston speed makes it possible to transfer heat to the expanding air, not sufficient to obtain exact isothermal expansion, but in a degree to obtain a large percentage of the gain due to isothermal expansion.

The engraving represents a compressed air pump manufactured by the Norwalk Iron Works Company, South Norwalk, Conn., which is designed to work at a high grade of expansion. The cylinder is water jacketed, through which the water of the mine is circulated. The temperature of this water being much higher than that of the expanding air, this water jacket becomes an efficient heater.

Corliss valves are used for both admission and exhaust, which reduces the clearance to a minimum. The point of cut-off can be varied to suit the requirements of each particular situation.

Simple means of lubrication are provided, the difficulties sometimes experienced in this respect being apparently entirely overcome.

The indicator diagram, taken from one of these pumps, graphically shows the small amount of clearance, and by its low terminal and large mean effective pressure the economy with which the air is used.



Compressed Air Pump.

Mr. W. Buchanan, Superintendent of motive power of the New York Central Railroad, and other gentlemen belonging to the management of the railroad branch of the Young Men's Christian Association, have been interesting themselves for some time in promoting means for the apprentices connected with his works in New York getting instruction in the technical part of their business in the evening. The details have now been arranged for holding a night school in the Grand Central Depot, Mr. C. L. Rogers, a gentleman connected with the drawing office being engaged as instructor. We understand the young men for whose benefit the school has been instituted, are eager to do their part in making it a success. The line of instruction to be followed will be to give a course of elementary mechanical drawing, beginning with the construction of simple geometrical figures. When the class has become familiar with the use of the few necessary instruments, the drawing of single details of machines will be taken up.

The Hartford Boiler Insurance Company, say in the *Locomotive:* "The causes of leakage of safety-valves are, of course, various, but the principal is either bad design or poor construction, bad design being responsible, in the majority of cases for too light casings, which spring in connecting up the valves, or from unequal expansion of heat, etc. Too broad seats are a fruitful source of annoyance, as it is impossible to keep them tight for any length of time, and such valves do not act with that sharpness and precision which is desirable."

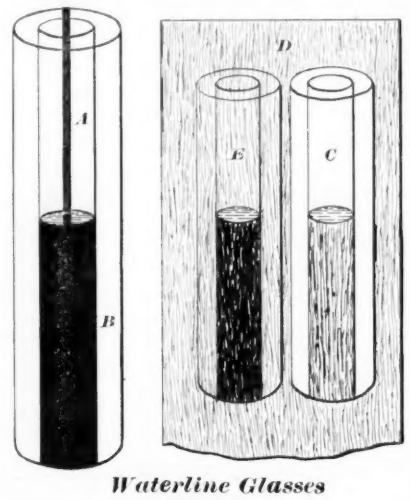
The Shop Index—Theoretical and Practical Engineers.

By James F. Hobart.

Every book has an index. Every shop has an index, too. The index of a book is between the title page and preface, and the first page of reading matter. In a shop, the index is right in the boiler room. No use of looking further. Two minutes in the boiler and engine room tell all about that concern. The owner's character is all over these rooms. The engineer may be flying around among dirt and leaking steam, trying to plug a leak where the steam-chest packing blew out; or he may be standing top of the cylinder, on tip toe, hammer and chisel in hand, trying to caulk that leaky elbow. The fireman is on the jump, too. He shovels shavings and coal, helps load and unload, and tends gate. No use talking; this slouchy fire and engine room extends clear through the shop. The owner is up in the office, and his dirty shirt-sleeve daubs a dirty day-book, while he charges a slouchy job on a dog-eared page with a pencil stub. Just like the fire-room!

The other shop has got the laziest fireman and engineer you ever met. The boilers seem to be asleep, fireman and all. A pile of shavings, a pile of coal, a shovel, broom, and 90 pounds of steam is all you see in that fire-room. In the engine room the engineer lays down the American Machinist as you walk in. No leaky steam or wet floors there. You never caught this engineer up to his eyes in cotton waste and oxalic acid. You never saw him polish a bit of brass, or wipe off any finished work. It is always bright. That engine runs 300 days every year, and the crackle of the belt and swish of dash-pots is all the noise you can hear.

When you went into the other fire-room you looked for the steam gauge. There it was, the other side of the room in that dark corner. Look twice; guess there's 45 pounds of steam; can't see very well. Then you look for the water-line glass. What makes you always look for the gauge and glass? You do it before you look at the fireman. It is instinct. The greenhorn don't do it—only the steam handlers. Bring a hundred men into our fire-room, and you can spot the steam lads before they get off the threshold. This water-line glass is high-colored. Inside



Waterline Glasses
Fig. 3

it is yellow and brown, where rust and mud have gathered; outside is dust, and white streaks where steam has sizzled out under the rubber packing. The water is somewhere in the glass, or it is somewhere else; you can't see it. The fireman opens the pet cock at the bottom of the glass, and when the water rises in the glass after the cock is shut he "tries it on the jump," and then tries the gauge cocks to see where the water really is.

The sleepy, neat-looking fireman had gauge and glass close together. He was too lazy to look in two places for steam and water, and then have to guess at it. You could tell where the water stood in the glass as you stood in the door, 20 feet away. One glass showed red water; the other looked double. Let's see this rig. Fig. 3 tells the story. The left-hand boiler glass had a narrow stripe of bright red painted on the back of it, like *A*. When water rose in the glass it formed a lens, and the stripe of red appeared wide as the bore of the tube, just like *B*. Mr. Lazy could tell where the water stood as far as he could see the glass.

The other boiler had a plain glass tube, like *C*. Many times it is difficult to tell where the water stands, unless you get your eye close to the boiler front, or the light comes in at the side of the boiler. Lazy found that when the light shone through the water he could see very plainly the height in the glass; so he got a long strip of ordinary looking-glass plate and put it behind the glass, like *D*, and he could see the reflected image of the water in *E* much plainer than he could see the water in *C*. It worked first-rate. *A* shows a little the plainest, but it will work off or chip; but the Crosby Steam Gage Company have imported some glasses having a red stripe blown in the glass, which fills the bill exactly. Put a glass behind your old tubes, boys, and see how nice it is; and when you want new glasses, make the "old man" get some with colored backs.

An engineer, to suit some users of steam, should be "cock-eyed." Then he could watch the engine with one eye and tend a lathe with the other. The man who owned the boiler where Mr. Lazy was fireman did not have any of this nonsense in his head. He wanted to see his engineer and fireman sit cool and comfortable, and read the engineering papers. When he saw his men flying around, he knew something was wrong. He believed in paying a doctor for "keeping people well," not for curing them when they got sick. The other man put an advertisement in his paper about once in two months. It read: "Wanted—A practical engineer to run engine and do repairs around the mill."

That line appears pretty often in some papers. The "practical" engineers all turn up their noses and say, "No, you don't." But the man who answers that advertisement would look sorry if he knew the full meaning of "practical." A man must understand the *theory* before he can become practical. A thin-skinned "tenderfoot," fresh from college, his head full of logarithms, his pockets stuffed with indicator cards, density tables, and algebraic formulæ, is as near being a "practical" man as is the "engineer" who "don't know why," or "does it because his father did." He may start and stop his engine all right, keep it well oiled and wiped, and get ten hours a day out of it, 300 days in the year, as long as the engine runs all right and don't "break down."

When an eccentric slips and nobody knows where it belongs, then you find that he is not a *practical* man by any means. He is a *mechanical* worker, and does his work because he has *learned* to do so—not because he has reasoned out the cause of some peculiarity of his engine, and from this cause reasoned out a remedy for it. No! He has learned that he can expect certain things to happen when certain things break, but he never knew why they were so, or cared either. The young college chap, if he has the grit and brains to commence in the engine-room, instead of jumping through the office window plump on to the drafting table, and begin by tracing drawings and running a ruling machine for $2 per week, stands a chance of being somebody. He has got the theory, and if he has got *brains* he will soon be *practical.* He will not swallow everything new that comes along. He will prove it first, and then will know whether to throw it away or to adopt it, and, if his valve got out of fix by shifting of the eccentric, it would not take him long to hunt up one of his theories, and set that valve where it belonged.

Ask an "engineer" his opinion of a "professional or expert' engineer, and he will gauge himself exactly in his reply. If he asks if you mean those "high-toned dudes" that were "shindying around with that 'ere indicator machine," you can form an accurate opinion as to his "practicability," and, by asking him how he would find the "point of cut-off for a given ratio of expansion," you would have your man in a corner so tight that he would need to be extracted by cube root.

There is nothing to prevent any "engineer" from becoming "practical" but his own ignorance. He can go to the top if he has inclination and brains, and the man who does not possess the latter has no business in the engine room. With the facilities at every man's hand now-a-days for acquiring

technical knowledge, there is no excuse for an engineer's not knowing how to get the best results out of his engine, or to put it in first-class shape if accidentally disarranged, or if it gets "knocked out" by something unforeseen.

We do not expect an engineer to be able to draft out and proportion a whole steam plant in economical detail; he has no business in the engine room if he has advanced to that, and will be called upon to lay down the oil cans and cotton waste and lay out work for others to execute.

No class of engineers, as a rule, need technical knowledge more than those connected with the wood-working industry (unless we except agricultural brethren), and no class has so poor an excuse for not possessing a greater knowledge of the powerful agent they are supposed to control.

One day, as I happened to be in an engine room, my attention was directed toward the engine by a peculiarity of the exhaust, and I called the engineer's attention to it. The engineer said he had "been figuring on that point himself, and thought the valve was set wrong." An appointment was made, after an "introduction to the owner," and at the stated time I was on hand with an indicator. A pair of cards were taken, and the trouble revealed. The engine did not take steam until the piston had traveled one-fourth its stroke! The cut-off began at end of stroke, and the engine exhausted almost at boiler pressure!

The engineer said he could not start except on the last half of the stroke, and then had to give the fly-wheel a "boost" the first time around. I explained the diagrams to him; set the valve, which, through slipping of the eccentric, had caused the trouble; explained to the engineer the method thereof, and started him to *thinking for himself*. A start in the right direction was all this man needed. He is to-day as good an engineer as ever turned on steam. He is often called upon to help others out of difficulties, and will soon quit the engine room for higher work. We have thousands of engineers who might save their employers thousands of dollars yearly if they would only go to thinking for themselves, and learn to be "practical engineers."

We also have a large number of men who never will learn to be anything but coal-heavers, and it is a standing disgrace to employers who keep men in responsible positions as engineers, when they cannot even comprehend that they are exposing themselves, together with the whole neighborhood, to destruction.

Users of steam will learn the lesson some day, or their sons will after the "worthy fathers" have been blown up with their boilers, and find it to their advantage to get the best engineers they can find, and then give them a chance to learn all they will. It will prove a paying investment, too, and our journals will not contain advertisements for a "practical engineer to run boilers and engine, and do repairs around the mill."

A French Co-operative Foundry.

Co-operative iron foundries are by no means novelties in the United States. Stove foundries on this plan have been in successful operation for a number of years. They are always started by an association of workmen. The following extract from the *St. James Gazette* tells of a French co-operative foundry on a different plan:

People who are interested in the reform of the relations that exist between capital and labor, will do well to procure a copy of the recently issued report of M. Godin's co-operative community at Guise, in the Department of Aisne. The association, which was founded in 1860, and at present consists of about fourteen hundred persons, carries on an iron foundry. The people live together in a group of specially constructed buildings, and, during the last twenty-five years, there has not been a single case of serious crime among them. The capital employed in the business is entitled to a preferential interest at the rate of five per cent. per annum, and all further profits are divided among the workingmen. In 1883 the dividends payable to the holders of the capital amounted to 230,000 francs, and those payable to labor to 1,888,000 francs, but the earnings of the workingmen are not entirely paid in cash. A certain portion of them is devoted to the gradual buying up, by the workers, of shares in the undertaking. Every worker thus in time becomes a capitalist, his share steadily increasing as years go on, and provision being laid up against his old age or disablement. In this fashion the proprietorship of the business passes down from generation to generation, although at present M. Godin's interest has not been entirely bought out.

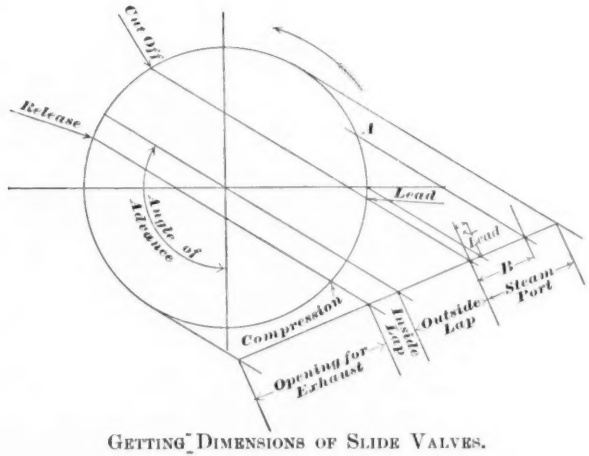
The proportion of profit due to each workman is dependent upon his abilities, conduct, and seniority. The members of the community are divided into five classes—associés (68), societaires (95), participants (573), auxiliaries (258), and interesses (286), the associés sharing at the highest and the interesses at the lowest rates. The average remuneration of each worker in 1883 was about 20s. 6d. per week—a wage which is far higher than that earned by foundry hands in ordinary establishments in England.

LETTERS FROM PRACTICAL MEN.

Getting Dimensions of Slide Valves.

Editor American Machinist:

The diagram shows my plan for getting the dimensions of a slide valve. The circle represents the path of the crank, drawn to $\frac{1}{4}$ or $\frac{1}{8}$ scale, and considering one side of the piston during one revolution, I fix the points where I want lead, cut off, release and cushion to take place, as shown in the diagram. These points I connect with straight lines, and if the lines don't come parallel, the points must be changed so as to make them do so. Then I cut these parallel lines across with an oblique line, in such a position as to make the distance marked steam port, correspond to the size of steam port wanted. The diagram will then give the other dimensions as shown. If the steam or exhaust opening for any position of the crank is wanted it can be found by drawing a parallel line, as shown at *A*, which in this case gives the steam opening *B*. J. B.



Getting Dimensions of Slide Valves.

Another Way To Pack a Piston Rod.

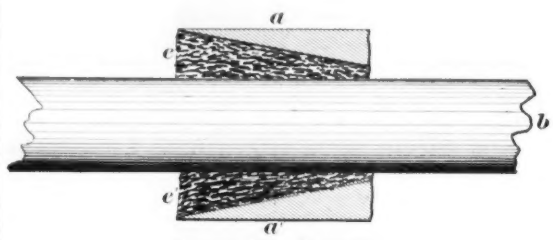
Editor American Machinist:

In No. 12 I notice an inquiry, "How to pack a piston rod that does not run true." There are metallic packings that ride on the rod, and will follow it if it runs out of line $\frac{1}{4}''$. Some of the metallic packings are put in solid in the stuffing-box with little or no chance to adjust themselves. Such packing should be avoided.

A simple way of packing a rod tight, is to measure the depth of the stuffing-box; if it be 6″, take a piece of heavy canvas or duck, cut two strips 6″ wide, and a strip of two-ply rubber (two of cloth and three of rubber), put the rubber between the strips of cloth and wind it around the rod until there is enough to fill the stuffing-box, and shove it in, screwing up the gland but slightly, as the rubber expands by heating. The wear comes on the canvas. When this wears through, and the rubber comes on the rod, there will be friction, and the packing should be replaced.

It would be more durable to wind a thin sheet of babbitt on the rod before putting on the canvas and rubber. Before using metallic packing, the writer found that represented in the cut an excellent and durable arrangement.

It was known as the Heston packing, in which *b* is the rod, *a*, *a'*, is a piece of rubber formed in the shape of a cone to just



Piston Rod Packing.

fill the stuffing-box. This is filled up with fibrous packing, *e e*.

The rubber forms an elastic back, requiring but light pressure on the gland, and adapts itself readily to a reasonable want of alignment in the rod. Its form, filled as it is with fibrous packing, keeps the oil from the rubber, and also the rubber from the rod. When it gets to leaking, a little fibrous packing put in, renews it.

Another method is to take a piece of rubber hose, if such can be obtained, that will fill the stuffing-box, or patch one up, and fill the space between it and the rod with fibrous packing.

The principle of both is the same, viz.: to have an elastic back for the packing.

W. E. Crane.

Boiler Makers' and Boiler Buyers' Methods—Boiler Explosion—The Oil Man—Cylinder Oil.

Editor American Machinist:

With reference to George Marshall's views in regard to the different irons used in the manufacture of boiler plate, it is all very well to talk of iron of 55,000 and 75,000 tensile strength. Good iron costs money. Now-a-days when a man wants a boiler he goes to Tom, Dick and Harry, to see which will make it the cheapest. The man that makes it the cheapest gets the job. Now, the man that makes it is not going to lose on it, consequently he buys the cheapest iron, and puts as little labor on it as possible. The purchaser will say the maker agrees to guarantee it. What does that amount to after he has got his money?

When a party says, "I want a boiler made of the best material and labor that you can put into it, and charge me what is reasonable for it," that man is going to get a good boiler.

It is a wonder there are not more explosions. Some people think that a boiler ought never to wear out. I was called to look at a boiler with a view to repairing it. It already had seventeen patches on it, and where one of the seams had given way it had an old Muley saw bent around it, with a piece of gum belt under it for a gasket, bolted on with $\frac{5}{8}$ bolts three inches apart. The owner felt very much discouraged when he found we could do nothing for him.

We had a steam gauge of the corrugated disk type come in for repairs. The spring had rusted away and we found a piece of thick gum belt in place of the spring. Such gross carelessness certainly brings its reward sooner or later.

In speaking of the explosion of the boiler of the Brazil furnace, it is hard to tell how that happened, as it took place early in the morning when the men were changing the shift. The night was very cold, and around the boilers was a good place for tramps to roost. To sleep on top of a boiler is a rather hot position, but to lay a plank across the levers of two safety valves and get on that is just right. Some one was blown through a freight car that stood on a side track, but it was hard to tell who he was.

I wrote you some time ago about the trouble we had with fraudulent oil. It does me good to get even with an oil man. A few days ago we got a ten-gallon can of bad cylinder oil. We telephoned for the oil man to come and take it away. He came, and was rather mad about it. We had just taken a lot of strong liquid ammonia out of the pipes of an ice machine. Any one that has smelled that knows what it is. Says he, "What is the matter with that oil?" "Matter, why just smell the nasty stuff!" He pulled the cork out of the ammonia can, and he took it all in. Well, he just fell over on the coal pile. I would probably have laughed if it had killed him. When he got so that he could speak, he came up to me, with the tears rolling down his cheeks, and fists doubled up. I thought he was going to thrash me; I could not have blamed him if he had. He says, shaking his fist, "Look here, Mr. Man, I will get even with you for this if it takes a hundred years."

We now use nothing but the best lard oil in our cylinder. It gives better results and goes much farther than those prepared oils. We use about two drops per minute. With the cylinder oil it took seven drops.

Benj. F. Hetherington.

Indianapolis.

Piston Rod Packing.

Editor American Machinist:

I see in your issue of March 31, that R. I. wants to know how to pack his piston rod. I know how annoying such things are, and will give him the result of my experience. I get the best result from rubber hose and hemp packing. I cut up a piece of hose (composed of rubber and canvas) long enough to go around in the stuffing box and hug the outside, leaving a space between the rod and the iron. That space I fill with hemp packing, not screwing very tightly at first. I repeat the filling with hemp every day until the stuffing box is filled, and find it entirely satisfactory. Gland.

Recording Work Done by Locomotives.

Editor American Machinist:

I notice in your paper a communication signed W. P. Div., relative to "Fuel economy with locomotives." The suggestions advanced are good, and are in use on many roads. But outside of the comparison of "loaded car miles" being nearer the truth than "engine miles," I do not see that it is the data needed for comparison. A "loaded car" on one road means a load of 20 tons; on others, 18, 16, 15, 13 tons, etc., and the variation is so great that for a correct comparison with other roads I cannot see much value to be attached to this method. Then some roads rate three empties as one load; others five empties as three loads, seven empties as four loads, etc., and here we are again against a stumbling block. A far more correct comparison would be "ton miles," but this would require extra clerical labor, and this would not give exactness, because one road is hilly, another level, and it is plain that it costs more to haul a ton on a hilly road than on a level one. It is claimed that the hilly road is no more costly to haul over than the level one, and theoretically this may be true, but practically the extra slipping in going up hills, and the loss of stored-up power in the train by the reduction of speed in descending, from the setting of the brakes, makes the hilly road much more costly. If there were no extra slipping of drivers, and the train were allowed to run down the hill unchecked by brakes, then there might be truth in the claim. I can only see that the exact comparison is foot-pounds of work done. A dynamometer test would give the necessary data for each road, and, until a comparison between roads can be made on the basis of foot-pounds of work done in hauling trains

of known weight over the roads, no safe nor exact comparison can be made. This would require more clerical work, and would be defeated on this account; but if railroads want exact data for comparison, it must be paid for, and the only question is, is the knowledge thus obtained worth the expense? Certain it is that a comparison based on any other measure than foot-pounds of work is utterly valueless and equally deceiving.

F. C. S.

Anchoring Top Chaplets of Column Cores.

Editor American Machinist:

The best method I find is simply to cast a plate, or any number of plates required, with wrought-iron nut in center; then have a bolt to fit the nut, with end concave, so as to fit over the end of the chaplet stem. After properly adjusting the plate on the cope directly over the chaplet, clamp or weight down the plate; then run down the bolt on the chaplet. It is now secure, so that the chaplet cannot become displaced while the piece is being cast.

Any practical moulder who may try this method will find it safe and convenient.

Montgomery, Ala. W. P. Mealor.

Apprentice School System.

Editor American Machinist:

In your editorial of March 21st, commenting on the circular issued by the Bureau of Education, you take the ground that a trade cannot be taught, or that a young man cannot learn a trade at a manual school.

The question at once presented itself to my mind: Does not that depend entirely on the manual school and the young man? According to my view of the case if one third or one-fourth of the money given for educational purposes were used to build and equip shops and furnish endowment funds for the purpose of buying materials and paying superintendents and foremen, and the shops run on the plan that everything done should be of use and value, and all the tools and operations performed be of the kind used and practiced in other establishments, the young man could and would get just as much of the trade at the manual school as he could get in three or four years' time spent in any other way.

To simply make such a statement without stating the reasons would be of no more value than any other man's opinion on either side, but let us see what there would be to do with, and in what way it could be made available.

Some years ago by an act of Congress large tracts of Government land were given to establish schools or colleges for the purpose of giving instruction in agriculture, mechanic arts, and military science. Nearly four hundred thousand acres of this land fell to this State, and to Cornell University. Added to this, Mr. Cornell gave upwards of three-fourths of a million of dollars, and directly to the mechanic arts departments Mr. Sibley has given from seventy-five to one hundred thousand dollars. If the mechanic arts department of that institution had its own it would naturally have (out of the several millions now owned by the university) at least one million dollars of property. What was received from the Government could have been used to pay the salaries of competent men to conduct the workshops where young men could gain a knowledge of mechanic arts. I positively know that the establishment of such shops was entirely in accordance with Mr. Cornell's hopes and wishes, and I fancy such a disposition of Mr. Sibley's money would have been quite as much in accordance with his aims as the discordant department of mechanic arts that has for the last seventeen years existed at Ithaca.

The number of students in the mechanical arts department would probably not exceed an average of fifty. Assuming provision had been made to accommodate one hundred apprentices (or students, whichever we choose to call them), but a very small portion of the million dollars would have been required for shops and equipment. There is no more reason why such an establishment should be self-sustaining than that a school of any kind should be.

There are certain features that should be managed the same as the schools for giving other instruction; the students should pay tuition and be dropped from each branch in turn or out entirely if they displayed no aptitude for the business, and in that it would be an improvement over the apprenticeship system. There are things about the other schools that should not be copied. The year should consist of at least 50 instead of 36 or 40 weeks; the weeks should be six days instead of five, and the days from ten to twelve or thirteen hours long. By making the shop work and drafting occupy eight hours per day, two hours for lectures and recitations, and two or three hours evenings for study and free hand drawing, the time would be so divided as to make no part in the least burdensome.

I understand perfectly that the schoolmen would object at once to the short time given to intellectual training. But it would give two hours each day more than the independent evening school you propose, with another advantage, that there could be a better relation established between the work and the studies.

It will be claimed at once that you could not expect to turn out mechanical engineers at such a school, or such a shop. It is not proposed in the question under discussion to make engineers, but to furnish a place where young men could learn a trade, and yet take 95 out of every 100 of our mechanical engineers, and what better opportunities did they have?

The Government lands were not given for the establishment of schools to train engineers, and yet that is the drift of the most of them as managed at present.

Of the two or three hundred young men who have been students in the mechanics art course at Cornell since its establishment, and out of the fifty odd who graduated from the department as Batchelors of Mechanical Engineering, there are about a half dozen working as mechanical engineers, or engineers' assistants who are possibly occupying positions higher than they would had they not had the benefits of the advanced studies they received at Cornell. For the other 45 or more they would have been as well or better off had they come out of their four years' course with a good trade and the really practical part of their education. Such of the remaining one hundred and fifty or two hundred, as were good for anything might have remained, gone through the course, and came out with some show of being of use to themselves and the community.

To establish a school of any kind three things are necessary: a place, the teachers and appliances for giving instruction, and the students. I have shown how the place and all the appliances, except the teachers, could have been at one time supplied, and as for teachers, they too, I believe, could have been found had the trustees applied for what they needed. Making the first requisite, one which requires that the man in charge shall be a college graduate whether he be a mechanic or not is not the rule men usually apply to business.

It may be doubted whether parents will send their sons or the young men go where the aim is to teach a trade with so much of a knowledge of the use of language, mathematics and other sciences as is necessary to make it useful. But I believe it quite probable that such a school would be overrun with applicants. Parents are generally pretty well satisfied when their children become able to support themselves.

That the manual training school cannot be made self-sustaining is true; but with building equipments and power furnished, it can be made as near self-sustaining as other schools. Rightly managed the articles made for sale will pay for the materials and services of the skilled help necessary for their production. The four or five hours given each day and evening to mental instruction is time enough to impart more facts and principles than most young men can remember. And the reason the mental and physical training at some of our colleges have not got on better together may be because there has been too much one-sidedness about it. Two hours a day in the shop and eight or ten hours to study, lectures and recitations is not an equal division of energies.

So far, the most of our industrial schools have been attached to, engrafted on or managed by the other schools, and those schools in the main managed by persons who have but little experience in industrial pursuits. Few people would expect to make good calico cloth in a woolen mill, shoes in a blacksmith shop, or maple sugar in a lime kiln. John E. Sweet.

Mark Patterns With a Blue Pencil.

Editor American Machinist:

Your correspondent, who finds chalk unsatisfactory for marking patterns, but wants something that will not be too difficult to remove, should use a blue pencil.

E. D. Mackintosh.

How to Mark Patterns.

Editor American Machinist:

Your correspondent, who inquires about marking patterns, can mark the number of pieces he wants from each pattern on a little slip of paper, and stick it on the pattern in some unexposed place with a small tack. This can be easily pulled off by the moulder, and will not injure the pattern, unless a very frail one. In that case, he can stick it on by one corner with a bit of pattern varnish. If the moulder loses the record after it is once shown him, he should be held responsible.

C. Wing.

How an Engineer Packed the Piston Rod on a Steamer.

Editor American Machinist:

I saw an article in the March 21st. issue of the American Machinist, signed R. I., about getting beat with a leaky piston rod. I have had the same trouble that he has. Last summer I was assistant engineer on the steamer R. P. Ramsey. She has a 23x48 and 52x48 fore and aft compound engine, and the high pressure piston rod gave us lots of trouble by blowing and burning out every kind of packing. The piston rod was steel and very rough, and did not run in line. The rod would get so hot as to change color, and the steam blew through so we could hardly see to oil the engine.

The chief engineer cut strips of rubber from an old air pump valve, a little smaller than the stuffing-box, and wound hemp around them, then covering them with plumbago and tallow, and put them in the box. From that time until we laid up we had no more blowing or hot rod. With a smooth rod it will run a long time, but ours was so rough it had to be rewound every trip. Our low-pressure rod I packed twice last season.

If soft rubber, like air pump valves, cannot be had, old rubber hose will be nearly as good. I think if R. I. tries this he will have no trouble. J. A. Morgan.

Spokes or Arms.

Editor American Machinist:

Your correspondent, D. W. Marmon, splits a fine hair when he objects to the word "spoke" for pulleys, gears, etc.

Language is the art of conveying ideas, and, when a word is accepted and conveys an idea, it is proper, whether it is in the dictionaries, and recognized by scholars, or not.

In this part of the country the words "spoke" and "arm" are used indiscriminately, and neither is a sign of verdancy.

The word "spoke" is the more expressive of the two, for, when applied to a machine, to the sea or to a man, the word "arm" naturally conveys the idea of a long and slender projection attached to a body at one end and free at the other. The word "spoke," from its long use in connection with carriage wheels, at once indicates a connection between a rim and a central body or limb. Again, is there any radical difference between the spoke of a cart wheel and the spoke of a gear wheel or a pulley wheel—anything that would require or suggest a different name? Geo. B. Grant.

Boston, Mass.

A Foreman's Opinion of What Manufacturers Should Do for Apprentices.

Editor American Machinist:

I would like to consider myself a manufacturer long enough to fill in a few replies to the questions of National Bureau of Education about apprentices. For instance:

Question No. 10.—"Do apprentices receive any considerable amount of direct instruction, or are they obliged to rely mainly upon themselves to gain a knowledge of the trade?"

Ans.—We appreciate the importance of this question. We take great pains to instruct our apprentices.

No. 12.—"Is any supervision exercised over your apprentices beyond the hours of their employment?"

Ans.—Only socially to treat them as gentlemen.

No. 15.—"Please add any general remarks which, in your judgment, the subject calls for."

What we pay apprentices the first year will, with close economy, board and clothe them. The second year we advance about 25 per cent., and about 33⅓ per cent. the third year.

We are careful to select good steady young men who expect to work for their living, and there are plenty of such young men who are anxious to learn the trade on such terms.

Any manufacturer who will follow out the above indicated policy will not suffer long for the want of good mechanics.

F. J. Masten.

Increased Steam Expansion.

Editor American Machinist:

As railroad master mechanics are striving in every way to reduce operating expenses, by making their locomotives do the work more economically, I would like to indicate an untouched line where saving might be effected. There is a practice among automatic stationary engine builders of supplying an engine so that the steam will be cut off at .25 or .3 of the stroke when driving an average load with a given boiler pressure. There has been some question as to whether this is the cheapest engine for the buyer. That is, whether the money saved at 6 per cent. by buying a smaller engine cutting off at, say .5 of the stroke, would not equal or exceed the saving effected by the larger engine cutting off at .25? There is no doubt but the larger engine is the more economical under ordinary circumstances, and I think the same source of economy might be applied to locomotives. For instance, the Lake Shore road is very level. The freight engines are loaded so heavy, that the reverse lever is never back of 18 or 20 inches.

Suppose now we put larger cylinders on these engines and raise the boiler pressure 20 pounds? We would then be able to get the same average pressure on the pistons, cutting off probably at 8 or 10 inches. There would, of course, be a larger loss from condensation in the larger cylinders, especially as the expansion would be greater, but on the whole there ought to be a material saving. The question is, what point of cut-off, and what size of cylinder should an engine have to handle the load most economically?

Superintendent.

The Mechanical Laboratory of the Stevens Institute of Technology has recently furnished an autographically recording testing machine to the Government of Mexico for the Mexican School of Engineering. These machines have been furnished to the United States, the Russian and Japanese Governments, to technical schools, railroads, and private purchasers. They give an autographic pencilled record of strength, ductility, elasticity, homogeneousness, etc.

In reply to an item in our issue of March 14, regarding the earliest times at which roller skates were made, C. E. Simonds writes us that a Frenchman patented roller skates in 1819, that the next patent was by an Englishman in 1823, and so on down to the first American patent in 1863.

Compressed Air Moulding Machine.

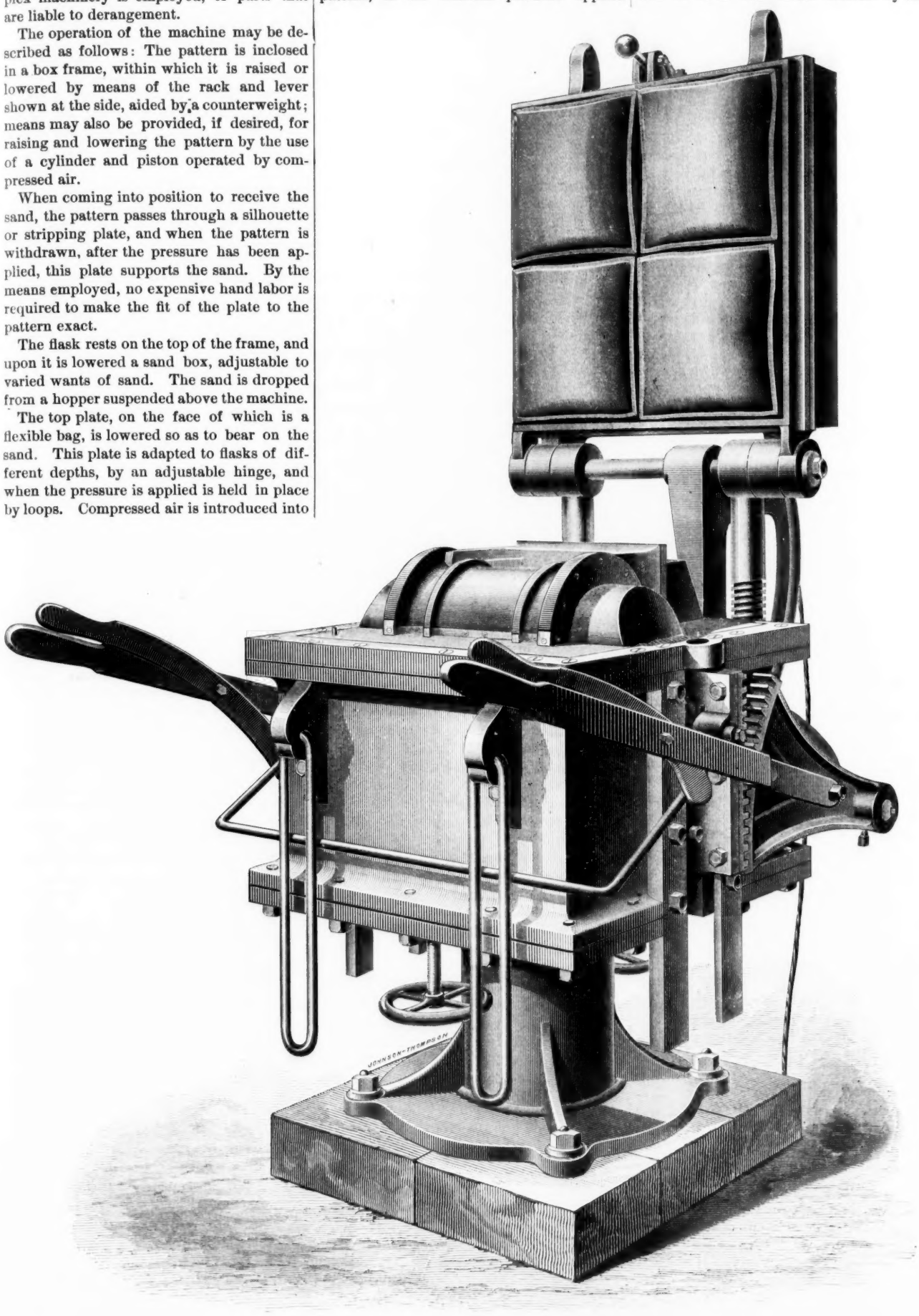
The Pneumatic Company, of Indianapolis, Ind., have recently perfected a moulding machine possessing novel features of operating, an engraving of which we present. The machine is adapted for making castings, large or small, and of any form. Its action is based on the general principle of a yielding presser or flexible diaphragm, and no complex machinery is employed, or parts that are liable to derangement.

The operation of the machine may be described as follows: The pattern is inclosed in a box frame, within which it is raised or lowered by means of the rack and lever shown at the side, aided by a counterweight; means may also be provided, if desired, for raising and lowering the pattern by the use of a cylinder and piston operated by compressed air.

When coming into position to receive the sand, the pattern passes through a silhouette or stripping plate, and when the pattern is withdrawn, after the pressure has been applied, this plate supports the sand. By the means employed, no expensive hand labor is required to make the fit of the plate to the pattern exact.

The flask rests on the top of the frame, and upon it is lowered a sand box, adjustable to varied wants of sand. The sand is dropped from a hopper suspended above the machine.

The top plate, on the face of which is a flexible bag, is lowered so as to bear on the sand. This plate is adapted to flasks of different depths, by an adjustable hinge, and when the pressure is applied is held in place by loops. Compressed air is introduced into the flexible bag through the top plate, the exact amount of pressure required being registered by a gauge. A two-way valve is used for admitting and releasing the pressure. When the air enters the bag, the entire body of sand is subjected to an elastic pressure, which conforms to the shape of the pattern, thus compressing the sand to a uniform density, leaving no hard spots and avoiding the necessity for probing, the gases finding free vent from all parts of the mould.



Compressed Air Moulding Machine.

After proving the pressure required for a mould, the safety valve is set to blow off at that pressure, making it impossible for any one, however unskilled, to exceed the limit, or through ignorance to improperly apply the pressure. The admission valve is simply held open until the safety valve blows, the entire operation being instantaneous, and the work proceeding as rapidly as the flasks can be carried to and removed from the machine.

Flasks used in this process of moulding do not require bars to closely conform to the pattern, as the uniform pressure applied admits of the use of a common flask for all classes of patterns. This uniform pressure also secures castings of the same thickness of metal, reducing the work in the machine shop and saving metal.

We are informed that the Atlas Engine Works, of Indianapolis, employ these machines for all their work, except engine frames and fly-wheels; also that with one of them both the cope and drag of a steam engine cylinder can be made in five minutes. If the machine works as well as reported, it is an important foundry appliance.

Economical Locomotive Operating.

At a recent meeting of the British Institution of Civil Engineers, Mr. William Stroudley, locomotive superintendent of the London, Brighton & South Coast Railway read a paper on the Construction of Locomotive Engines in which some remarkable statements were made. The portion relating to the amount of fuel used by the locomotives of the road will be read with much interest by those who pay attention to the expense of operating railroads. In this regard Mr. Stroudley said that the average of the whole engines on the line for the half year ending June 30, 1884, was 29.74 pounds per engine mile including the coal used in raising steam. A great number of careful tests had been made of the amount of coal required to raise steam in the engines from cold water, and also from the partially heated water when the boiler had not been emptied, and this amounted on an average to about 3 lbs. per mile run. Some doubt had been expressed as to the value of heating feed water by the exhaust steam. Mr. Stroudley, therefore, had a number of tests made with the ordinary heating apparatus removed, and water fed to the boilers by the feed pumps, and in one series by a Borland injector. The amount of power required to work the pumps was inappreciable; and the heated feed water brought about reduction in the consumption of fuel to the extent of over 2½ lbs. per train mile. It had also been found that heating the feed water by direct contact of the steam did not, on this railway, injuriously affect the boiler plates. With a view to ascertain what was the amount of power required to haul a train from Brighton to London, a complete set of 49 diagrams was taken from the engine Gladstone working an express train of twenty-three vehicles; the total weight of train, and engine being 335 tons 14 cwt. A section of the line was given, and clearly illustrated the result, giving the horse-power at about every mile, the speed and the gradient. The temperature of the gases in the smoke-box was taken at frequent intervals; also the degree of vacuum in the fire-box and in the smoke-box, and the quantity of water used out of the tender. To the latter had to be added the water condensed from the exhaust, which from experiments the author estimated at 20 per cent. This gave an evaporation of 12.95 lbs. of water per 1 lb. of coal, and 1 lb. of coal would convey 1 ton weight of the train 13½ miles, at an average speed of 43.38 miles per hour, over the Brighton Railway, the rate of consumption being 2.03 lbs. of coal per horse-power per hour.

We clip the following from the New York *Mail and Express* of March 21:

"Where are the electric motors?" asks the American Machinist, this week, and Mr. Johnson, president of the Electric Railway Company of the United States, was requested, at the office of the Edison Company, No. 65 Fifth Avenue, yesterday afternoon, to reply to the question.

"We have made the preliminary tests at the Edison Machine Works, No. 104 Goerck Street," he said, "and have found everything satisfactory, and all our plans are now just as we wish them, and the work which remains is simply to make the transfer to the completed motor car. I see no reason why our exhibition on the Second Avenue elevated railway should be later than early in May."

"I have ordered a car from the Pullman Company," said Mr. Batchelor, general manager of the Edison Machine Works, who entered Mr. Johnson's office while the conversation was in progress, "and it will be taken to our works and an electric motor will be inserted in each truck, and then it will be put on the Second Avenue line. It will take less than a month to prepare the first car. The Pullmans are now building a large number of cars for the Manhattan Company, and when electricity is substituted for steam our motors can be attached to them and to all the other cars now in use."

"That is one of the great advantages of our system," resumed Mr. Johnson, as Mr. Batchelor stepped to the telephone to communicate with the Pullman office in the Mills building. "Our motors can be inserted in the trucks of any car, and the increase of weight will not exceed a ton for each car. As the Manhattan locomotives weigh sixteen tons, the use of our motors will save twelve tons of dead weight on each train of four cars, and as the weight will be distributed over thirty-two wheels, the strain upon the costly Manhattan structures will be very much reduced. I do not see what the Daft Company is to gain by merely running a train with an ordinary electric motor on Ninth Avenue, for that has been done in a score of places. What we wish is to solve the mechanical and engineering problems involved in the practical operation of railways by electricity, and we shall do it very soon, I perfectly believe."

In another part of the paper the *Mail and Express* says:

It may be regarded as certain that electric motors will be exhibited on the elevated railways before the end of spring, and it is not improbable that electricity will be substituted for steam as motive power on all the Manhattan lines before the end of next summer.

We trust our contemporary the *Mail and Express* is correct in the statement that electric motors will be exhibited on the Elevated Railroads at an early day. The experiment of operating ordinary trains by electricity will be watched with interest by the whole mechanical world.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.
JACKSON BAILEY, Vice-Pres't.
LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, ANGUS SINCLAIR, } Mechanical Engineers.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 BOUVERIE STREET (Fleet Street), LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The American News Company, New York.
The American News Company, Denver, Col.
The American News Company, Kansas City, Mo.
The American News Company, Omaha, Neb.
The American News Company, St. Paul, Minn.
The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St Louis News Company, St. Louis, Mo.
The Cincinnati News Company, Cincinnati, O.
The Detroit News Company, Detroit, Mich.
The Pittsburgh News Company, Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Company, Providence, R.I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, N. Y.
The Williamsburg News Co., Brooklyn, E. D., N. Y.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Washington News Company, Washington, D.C.
The New Orleans News Company, New Orleans, La.
The Montreal News Company, Montreal, Canada.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$2.50 a year in advance, postage prepaid in the United States and Canada.

$3.50 a year to Foreign Countries, postage prepaid, except Bolivia and South Africa, to which the subscription rate is $4.50 a year, postage prepaid.

ADVERTISING.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we reprsent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, APRIL 11, 1885.

CONTENTS.

	PAGE
New Heavy Milling Machine	1
Early Engineering Reminiscences. By George Escol Sellers	1
The Balance of Rotary Parts of Machinery. By John Coffin	2
Horton's Self-Oiling Loose Pulley	3
Threading Tool for Square Threads	3
Rules for Management and Care of Steam Boilers	3
Compressed Air Pump	4
The Shop Index. By James F. Hobart	4
A French Co-operative Foundry	5
Leters from Practical Men—Getting Dimensions of Slide Valves—Another Way to Pack a Piston Rod—Boiler Makers and Boiler Buyers Methods, etc.—Piston Rod Packing—A Foreman's Opinion of What Manufacturers Should do for Apprentices—Anchoring Top Chaplets of Column Cores—Apprentice School System—Mark Patterns with Blue Pencil—How to Mark Patterns—How an Engineer Packed the Piston Rod on a Steamer—Spokes vs. Arms—Increased Steam Expansion	5, 6
Compressed Air Moulding Machine	7
Economical Locomotive Operating	7
Is the Locomotive a Wasteful Engine?	8
Investigating Industrial Depression	8
The Despatch Boat Dolphin	8
Literary Notes	8
Questions and Answers	9
Manufactures	9
Machinists' Supplies and Iron	10

Is the Locomotive a Wasteful Engine?

On another page we give extracts from a paper on "The Construction of Locomotives," read recently before an English engineering society by Mr. Stroudley, C. E., locomotive superintendent of a prominent English railway, and well known as a designer of railway machinery. Mr. Stroudley was the designer of the express locomotive "Gladstone," which most of our readers familiar with English engineering, will remember has two pairs of driving wheels in front without any truck or small leading wheels. The back part of the engine is supported by a pair of small wheels under the cab. This is by no means a new form of locomotive, for smaller engines of the same general outline were very common in Great Britain thirty years ago, but the type was not then regarded as safe for very fast running, and there was more or less trouble with the leading drivers cutting their tires. Mr. Stroudley has adopted this form as his fast express locomotive, because of the fact that the drivers being placed in front of the fire-box gives him short side rods and enables him to have a larger boiler than could be obtained with the driving wheels behind. His constant aim in working out the details of the engines was to secure economy in operating, and if the figures he gives are correct he has been successful in an extraordinary degree. Those amateur engineers in this country who are struggling to reform our locomotives, and are broken-hearted because master mechanics will not perceive the ruinous effects of compression in high speed locomotives would do well to study the work Mr. Stroudley has accomplished. The proportions of his valve motion gave an admission of 78 per cent. of steam in full gear, which he found could be reduced to 12 per cent. with excellent results. At high speeds the steam was never exhausted, the temperature of the cylinders was maintained and as much steam was locked up in the cylinders as brought the pressure at the end of the stroke to near that in the steam chest. This he said made the engine run smoothly at high speeds, and turned, what would otherwise be an extravagant coal burner into an economical machine. Working an express train with this engine, the whole weight of train and engine being over 335 long tons, Mr. Stroudley found that the work was done with a fuel expenditure of 2.03 pounds of coal per indicated horse power per hour. He claims that the evaporation of water was 12.95 pounds to the pound of coal.

This is certainly a most extraordinary statement and it is hard for us to believe that some mistake has not been made. But the experiments were no doubt carefully carried out by thoroughly competent engineers and Mr. Stroudley has a high reputation that raises him above the suspicion of deception. The engineering world has so long regarded the locomotive as one of the most wasteful forms of prime movers, without investigating closely on what data this belief was founded, that evidence tending to prove it different is likely to cause considerable surprise. Yet other engineers who have devoted attention to developing the economical application of steam by the locomotive, and have accurately ascertained the results, have not come far behind the record claimed by Mr. Stroudley. In a series of experiments made by M. Georges Marie, chief engineer of the Paris and Lyons Railway, and reported about a year ago, ordinary trains were run with fuel consumption averaging 3.01 and coming as low as 2.88 pounds of fuel per horse power per hour. About the time these results were recorded, M. Regray, chief engineer of the Eastern Railway of France, was investigating the same subject, and he obtained one indicated horse power per hour with 2.48 pounds of coal. No exhaustive and carefully conducted experiments have ever been made in this country to demonstrate exactly the consumption of coal required per indicated horse power in running fast express trains. When this desirable engineering work becomes accomplished, we predict that our locomotives will be better spoken of in comparison with other engines.

Investigating Industrial Depression.

Mr. Wright, the Commissioner of the new Labor Statistics Bureau, appears anxious to enter thoroughly into the investigation of important labor and industrial problems. He recently outlined for the Secretary of the Interior, and received cordial encouragement to proceed with, an investigation of the question of industrial depressions, involving a study of their character, their causes, and whether they are contemporaneous in the great producing countries of the world, and whether, as to duration, severity, and periodicity, they are alike in such countries. Such an investigation would involve the question of the influence of depressions on the cost of living, the extent to which industries have been developed, and the cost of production reduced through the use of machinery in the great industrial centers, and the difference in rates of wages in like industries in different localities of the United States; the influence of climate on the use of machinery and the rates of wages and the cost of living; the influence of taxes on all matters relating to living and as to industrial depressions, how far "corners" may be influential in such matters; the productivity of labor in various localities; the influence of distribution and transportation of foreign immigration and the employment of foreign contract labor in bringing about depressions; what industrial, commercial, and financial conditions have preceded such depressions, and whether large importations or exportations or extensive railroad building, etc, have preceded them.

The Despatch Boat Dolphin.

The United States despatch boat Dolphin, recently built by John Roach, and which broke her steel propeller shaft on the first trial trip, has now got a new shaft of iron and has made several trips, and the Advisory Board of the Navy are reported to have been satisfied with the performance of the vessel. But Secretary Whitney, of the Navy, has declined to accept the vessel because she did not show the collective horse power on trials that was expected out of the engines. Another trial is ordered, and the Advisory Board has expressed the opinion that the deficiency of indicated horse power required was not due to defective work nor materials, and that with better coal and a well-trained engineer force the required horse-power would be obtained. It seems curious kind of management to send out a vessel of this kind for trial with a poor quality of coal and under an inefficient force of engineers. Is the engineering department of the Navy so crowded with work that a proper crew could not be spared for the important and too unusual duties of trying a new boat? Should a better quality of coal, and the best engineering ability available fail to make the Dolphin's engine develop the expected power, we do not see how the builder would be to blame. He did not design the machinery nor have any influence over the proportions of the engine. These were furnished by the naval authorities, and an officer belonging to the Navy was constantly overlooking the progress of the work. From what we saw during frequent visits to the machine shops of the Morgan Works when this machinery was being made, we believe it was produced in a thoroughly first-class workmanlike manner. If the boat is not satisfactory the blame should be put upon the designers.

One of our Wheeling contemporaries, which generally insists on rigid obedience to the natural laws of supply and demand in trade matters, has been screaming for the "boycotting" of steel nails, because the universal use of steel in nail-making would throw fourteen thousand good citizens of Wheeling out of employment. In a recent issue the paper referred to says the boycotting is going bravely on, and steel nails "must go." We doubt this. If steel nails are not so good for the purpose intended as iron nails are, they will not come into general use; but if they are better, and can be made as cheaply, all the boycotting in the world will fail for very long to keep them out of the hands of carpenters. It may work bad for Wheeling, but the world's business cannot pause before a change of methods is introduced to consider its effect upon any particular locality.

On some of our leading railroads that have tried large wheels under their passenger equipment serious trouble has been experienced with the wheels getting loose on the axle. The leverage is so great on the small axle when the wheel strikes a heavy blow on the side of a frog that in many cases the axle is sprung or the wheel started. Some of the roads are giving up the 42 inch wheels on this account, and others are considering the desirability of increasing the size of the axle.

One of the leading New York dailies recently directed attention to the alarming menace to human health in the presence of fine iron dust in the atmosphere, put there by the grinding action of the car wheels of the elevated railroads. The danger was reported to be so pressing that cholera and ordinary epidemics are nothing in comparison. The writer who sounded this note of alarm alleged that the only remedy was to place the railways underground, as is done in European cities. We were not aware before that iron was so dreadfully dangerous to the human system unless it appeared in the shape of a knife, but we know now that a touch of ague that shook us up last year must have been caused by the iron from the elevated railroad trains. But, since this new origin of disease has been pointed out, we are afraid that numerous iron-working establishments within our cities must be sowing the germs of disease in the shape of iron dust much more extensively than the elevated railroads. When we reflect on the matter, we are astonished to find any one alive within ten miles of a cutlery shop.

There is something very curious about the miners' strike in the Hocking Valley, for every week for the last three months the Associated Press dispatches have intimated to all concerned that the strike is at an end and the men returning to work. The ends in this case have been bewilderingly numerous, and we would like to know which one was most important.

Our occasional correspondent, Mr. Pierce Butler, has opened an office in Louisville, Ky., where he is found ready to engage in any mechanical engineering work. Mr. Butler is a graduate of one of our best technological schools, and he has been for the last year or two in charge of the apprentice school connected with the Brooks Locomotive Works, Dunkirk, N. Y., where he made many warm friends. Along with these we trust that Mr. Butler has found what will prove a fertile engineering field in Louisville.

Literary Notes.

We have received the first number of the *American Eagle*, a new weekly paper published at 7 Poultry, London, England, and must protest against the bad taste displayed in relegating the American eagle to poultry. That noble bird cannot be associated with the feathered inhabitants of the barnyard.

A HANDBOOK ON THE TEETH OF GEARS; Their Curves, Properties and Practical Construction; with Odontographs for Epicycloidal and Involute Teeth, Rules for the Strength of Teeth, a Table of Pitch Diameters, and much other general information on the subject. George B. Grant, 69 Beverly Street, Boston, Mass. Price, $1.

The author of this book is well known as a practical constructor of gearing, and to the readers of the AMERICAN MACHINIST as a contributor to its columns on this subject. In the present work he gives, in a clear and concise manner, information that will be appreciated by machinists, mechanical engineers, and draftsmen. The forms of gear teeth, manner of construction, horse-power,

strength, the curves in use and their properties, are fully explained. Tables of pitches, pitch diameters, clearances, etc., are given. Rules and tables are applied to spur, bevel, miter and internal gearing, for involute and epicycloidal teeth, and on both the diametral and circular pitch system.

Mr. J. G. A. Meyer, chief draftsman of the Grant Locomotive Works, who contributed a series of articles on "Laying Out Link Motion" to the AMERICAN MACHINIST last year is engaged writing a book that will be very valuable to the engineering world when published. Mr. Meyer proposes to treat of physical science in an elementary way suitable for mechanics, give plain instruction in mechanical drawing, treat at great length on the steam engine, explaining the principles of its action and details of its construction. The plates with which the book will be profusely illustrated will be of great assistance to engineers engaged in steam engine construction.

In giving a decision in a recent law case, Chief-Justice Cole, of the Wisconsin Supreme Court, said: "Where a person hires a man or machine by the day at a fixed price, and he sees the work done, he must pay the hire if he witnesses the work, and he cannot have any damages for bad work done."

George B. Foote, Helena, Mont., wishes us to announce that he will donate to all mechanical schools and colleges a license to use his arbor, illustrated in our March 21st issue. This, of course, does not carry the right to manufacture for sale.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(119) **A. W. B., Peru, Ind.,** asks a question about the pitch of gear wheels, for answer to which he is referred to the Question and Answer columns of the AMERICAN MACHINIST of September 8, 1883.

(120) **P. S. P., Everett, Mass.,** writes: I have castings for an engine 1½"x3". The steam ports are ¼"x⅝". 1. Can I run it at 300 revolutions? *A.*—Yes. 2. What lap should there be to cut off at ¾ stroke? *A.*—Steam lap, ⅛"; travel of valve, ½". 3. About what horse-power will I get? *A.*—Steam pressure 80 lbs., about one-third horse-power. The valve, of which you send sketch, is in very common use. We should not advise you to use it.

(121) **W. W., Hartford, Conn.,** asks: 1. I want to varnish some drawings. Can you give me a recipe for a varnish that will set in a short time? *A.*—See answer to question 69, Feb. 28, 1885. 2. How much saving is there in the use of a cutting-off machine for steel over the old process of cutting off in the blacksmith's shop. I mean the saving in cutting off, without reference to turning, etc.? *A.*—This will depend largely upon the size of the steel to be cut. It may be nothing, or it may be 100 per cent. In a general sense, there is no question of the economy of a cutting-off machine. 3. Do you know of any other drill than a flat one that will work for a cored hole? *A.*—A drill with four cutting edges, like a rock drill, is better for a cored hole than a flat one.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Katzenstein metallic packing, 169 Christopher st., N Y

Curtis Pressure Regulator and St'm Trap. Mar. 21, p 14

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Tools for amateur and foot power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

The Young Engineer's Own Book, $3. Edw. Meeks, Publisher, 1002 Walnut St., Phila., Pa.

For Sale—26" b. g. drill presses, quick ret'n bal. spindles, new, modern tools, $150. S. M. York, Clev'd, O.

Kellam's Steam Pressure Regulator is meeting with great favor. See cut, page 12.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N.J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Cooper, On the Use of Belting, $3.50. Edw. Meeks, Publisher, 1002 Walnut St., Phila., Pa.

Engineers, send for sample of Eureka Packing. It will please you. Hine & Robertson, 12 Cortlandt Street, N. Y. City.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

A few chucks, of all kinds, for sale at half price. Slightly damaged. Send for list to the maker, A. F. Cushman, Hartford, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught," $4. Books for workmen. John Rose, Box 3306, New York City.

Locomotive Engine Running and Management. By Angus Sinclair. Price $2. An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

Useful Information for Steam Users—A 100-page pamphlet, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Every engineer should have this book. Send 25c. in P. O. stamps to the J. N. Mills Publishing Company, 145 Broadway, N. Y.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES.

J. H Wells, Tampa, Fla., is to extend his machine shop.

The Rumford (R. I.) Chemical Works will erect a new factory 250x55 feet.

The Buckeye Buggy Company, Columbus, Ohio, will erect a new factory.

Mrs. E. Smith will erect a $12,000 factory at 30 Desplaines Street, Chicago.

C. A. McKinnon, Aberdeen, Miss., and others, will build a cotton seed oil mill.

A machine shop 50x80 is being built by a new company, at Fort Valley, Ga.

J. M. Scott, West Point, Ga., will probably establish a plow factory shortly.

Dale & Hart will erect a brick factory at 45 Fourth Avenue, Chicago, to cost $45,000.

The Capital City Tool Company, Des Moines, Ia., are about to build a new axle lathe.

Cowan & Van Horn, Maryville, Tenn., will build machine shops for general jobbing.

Royce & Pulling, steam pump manufacturers, Columbus, Ohio, will enlarge their works.

Corsicana, Texas, has disposed of $80,000 of bonds for the purpose of building water works.

A cotton factory, with a paid-up capital of $200,000, is in course of erection at Taladega, Ala.

The Little Giant Plow Company, Mansfield, Ohio, expect to erect new shops this coming summer.

Cornelius Daly will erect a 4-story brick factory at 562 West 34th Street, New York, to cost $9,000.

D. Culhane, 87 Fourth Street, Brooklyn, N. Y., will build a 50x60 foot factory on Van Cott Avenue.

The Star Wagon Company, Cedar Rapids, Iowa, will start a machine shop next fall, to do repair work.

The Goss Marine Iron Works, Bath, Me., have been sold to the New England Ship Building Company.

J. Matthews, proprietor of the South Bend (Ind.) Boiler Works, contemplates the extension of his plant.

The Franklin (O.) Machine Company, just incorporated, will purchase machinery to build steam pumps.

Wm. H. March, 22d Street and Washington Avenue, Philadelphia, will build a new iron foundry, to cost $10,000.

Colonel C. Powell is president of a foundry company that will start stove works at Johnson City, Tenn., in May.

Van Riper & Rogers, proprietors of the Neosho (Mo.) Foundry and Machine Shop, will build a new shop this spring.

Emerson McDuffie Marion, S. C., is building a small foundry to his machine shop and putting in new machinery.

The Louisville & Nashville Railroad Company, Louisville, Ky., contemplate erecting shops at South Louisville, Ky.

There is a great deal of inquiry for machinery, but most of the would-be purchasers are not quite ready to give orders.

It is rumored that the Fitchburg R. R. Company intend putting in a repair shop at Greenfield, Mass. the coming summer.

The Stovering & Fleming Foundry, Cleveland, Ohio, recently destroyed by fire, will soon be rebuilt on a larger scale.

The Charlotte (N. C.) Oil Company, will soon build a cotton seed oil mill at Columbia, S. C., to use 75 tons of seed a day.

Thomas Ketchum, Fort Smith, Arkansas, will start a new foundry and machine shop, to be equipped with new machinery.

N. J. Anderson & Son, Knoxville, Tenn., will start a foundry for the manufacture of hollow-ware. About 15 hands will be employed.

Wm. Scholes & Son, Coral and Adams Streets, Philadelphia, Pa., will erect a woolen yarn factory on Second Street, to cost $10,500.

Cleveland & Hardwicks, engine builders, Erie, Pa., will build two brick machine shops and an office. Estimated outlay, $10,000.

A proposition to bond the city for $10,000 for water works will be submitted to the Stanton, Mich., people at the coming election.

A company has been incorporated in West Virginia by Boston capitalists, with a capital stock of $150,000, to manufacture paper slippers.

Roswell Smith and Theodore L. DeVinne will erect a manufactory, to cost $200,000, on Lafayette Place, Corner of 4th Street, New York.

The Republic Rolling Mill Company, of Pittsburgh, Pa., will build a large addition to their mill, to increase their facilities for working scrap.

It is reported that there is a probability of the erection, in Massillon, Ohio, of a plant for the manufacture of nails from Bessemer steel.

Novelty Iron Works Company, Kansas City, Mo., have just added to their foundry a machine shop, with about $4,500 worth of new machinery.

The repair work and building for the Burlington & Lamoille Railroad is hereafter to be done at the Central Vermont railroad shops at St. Albans, Vt.

B. F. Wilson, will start extensive boiler works at Knoxville, Tenn., about July 1st. He expects to employ about 100 hands and to invest about $50,000.

The James Flue Cleaner Company, Hartford, Conn., has been incorporated. Incorporators, Isaac B. Davis, James E. Davis, and John O. Davis.

The Pittsburgh, Fort Wayne & Chicago Railroad Company are considering a proposition to remove their shops from Fort Wayne, Ind., to Rochester, Pa.

Penny, Mulholland & Company have leased ground in McKeesport, Pa., and will at once commence the erection of a large foundry and machine shop.

The Benwood Iron Works, of Benwood, W. Va., have completed their new nail mill, and now have under construction an extensive Bessemer steel plant.

T. M. Nagle, Erie, Pa., will erect a new building to be used as a boiler shop. The building will be fitted with new machinery. Estimated outlay, $20,000.

A. P. Maltby, proprietor of the Arkansas Valley Foundry and Machine Shop, Hutchinson, Kansas, expects to enlarge his plant and add some new machinery.

The Newark (O.) Council has passed an ordinance to issue bonds to the amount of $3,250 to start the Blandy Machine Works, which have been idle several years.

It is reported that the American Linen Company, Fall River, Mass., is about to add 300 more looms to its present weaving capacity. It now employs 2,038 looms.

The Eastern warerooms and agency of the Niles Tool Works has removed from 22 South Sixth St., Philadelphia, to more commodious quarters at 713 Chestnut Street

The *Baltimore Manufacturers' Record* says: "Benjamin F. Wilson, of Madison, Wis., is now in Knoxville, Tenn., investigating the advantages of that place for steam-engine works."

The Louisville, New Orleans & Texas Railroad have secured ground at Vicksburg, Miss., and are erecting repair shops. J. M. Edwards, of New York City, is general manager.

The New Central Coal Company, Lonaconing, Md., contemplate placing another stationary engine in their Koontz mine for the purpose of hauling coal out of the dip headings.

The Cleveland *Iron Trade Review* says: "Workmen in the Atlantic Iron Works, Sharon, Pa., have decided to accept pay in store orders, with balance in cash, and the works will resume."

W. W. Whitney has posted a notice in his factories at Winchendon, warning employes that they will be discharged upon evidence of their becoming intoxicated.—*Boston Commercial Bulletin.*

Wm. J. Schubert, proprietor of the Fedonia (Kan.) Machine Shops, will enlarge his plant this spring, and add an engine and boiler, also planer and lathe. He also reports business as improving.

W. H. Pease & Son, Elkhart, Ind., have recently started an establishment for the designing and building of special automatic machinery for manufacturers. Some new machinery will be added.

The Corbin Cabinet Lock Company, of New Britain, Conn., will erect an addition to their factory this spring, to be used for the manufacture of locks and screws. New machinery will be put in.

The Strange Forge, Drill and Machine Company, New Bedford, Mass., has been organized. Capital stock, $60,000. Samuel E. Hart, president; Chas. E. Cook, treasurer. They will erect a shop at once.

The Cleveland Twist Drill Company, Cleveland, Ohio, who were obliged to stop on account of a break down of their engine, have started up with orders enough to warrant the employment of additional hands.

The Florida Southern Railroad will be extended a hundred miles as soon as the track can be built. Superintendent Hollister writes us that their mechanical facilities will also be increased at the shops in Palatka, Fla.

The Brooklyn Elevated Railroad will be in operation for about six miles in a month or six weeks. The company is building repair shops and car sheds on a plot of ground at East New York, N. Y. They will be ready for work in a few weeks.

The Portland (Pa.) Iron Works will erect a branch machine shop at Pen Argyl, and equip with new machinery. It will be used as a repair shop. The owners, Bartron & Pearson, will continue to build engines and other machinery at Portland.

The 1,500 employes in the Manville, R. I., Cotton Mill, one of the largest in the country, have had their pay advanced 5 per cent., the officers of the company making the advance voluntarily, believing that the outlook in the market is brighter.

Nichols, Shepard & Company, Battle Creek, Mich., manufacturers of agricultural machinery, are running their shops ten hours a day, with the prospect of being obliged to employ an extra number of men to fill orders for the coming season's trade.

The shops covering the square between Croghan and Macon Streets, Detroit, Mich., which were formerly occupied by the Pullman Car Company, will be reopened by the Wagner Car Company, and used as repair shops. About 200 men will be employed.

The Mann Envelope Company, Ballston Spa, N. Y., lately incorporated, are occupying building formerly used by the Glen Paper Collar Company, in which there is a forty horse-power engine and boiler. They are manufacturing their own envelope machines.

The Hewes & Phillips Iron Works, Newark, N. J., have issued a very neatly illustrated catalogue of their Corliss engine, and of various forms of boilers built by them. Their engine which is running at the New Orleans Exposition is attracting a good deal of attention, and is already sold.

The Ridgeway Furnace and Stove Company, of Nashua, N. H., has been incorporated to manufacture a patent furnace and stove. Capital stock, $50,000. Incorporators, John W. Corcoran, Edw. G. Stevens, Chas. W. Field, Jr., Frank E. Howard, Wm. H. Gibbs, and Oliver M. Knight, of Portsmouth, N. H.

Benjamin Summers, Petersburg, Va., writes us: "My entire foundry and machine shop were totally destroyed by fire, including everything the shop contained. Loss about $5,000; insurance $2,700. The lumber has been ordered for a new foundry and machine shop, which will be built separate, and twice the capacity of the old one."

D. M. Osborne & Company, of Auburn, N. Y., recently doing business under the same title, has been incorporated for the purpose of manufacturing mowers and reapers in New York and Colorado. Capital stock, $300,000. Directors, David M. Osborne, John H. Osborne, Alonzo G. Beardsley, Cyremis Wheeler, Jr., William A. Kerby, Henry Morgan and Orvin H. Burdick.

The Westinghouse Brake Company, Pittsburgh, Pa., have recently received orders for the equipment of freight cars with their brake from the Chicago, Rock Island & Pacific Railway, the Chicago & North Western Railway, and the Chicago, Milwaukee & St. Paul Railroad. The companies making this new departure with their freight cars, do it as an experiment, to see what practical advantages accrue from having freight cars controlled by a continuous brake.

There was an attempt made to settle one controversy that has arisen in regard to the merits of steel and iron nails, by a test experiment. It was stated in the Wheeling *Register* that there were eight more iron nails in a pound than in the same weight of steel. A half pound of steel and a half pound of iron nails, 8-penny, were counted by mill men, and it was found that there were five more iron than steel nails in the half pound. Therefore, in one keg there are 1,000 more iron than steel nails. The nails used in this experiment were all made at the Top Mill, and this test substantiates and adds to the former statement that there were 800 iron nails gained in a keg.—*National Labor Tribune.*

Machinists' Supplies and Iron.

New York, March 26, 1885.

The supply trade continues quiet, and the hopeful feeling regarding an improvement still exists, but the volume of trade done shows little increase thus far.

Iron—There has been no change in prices for pig since we last wrote. The market has been quiet and steady, with, perhaps, a slightly improved demand. We quote Standard Lehigh brands $18 to $18.50 at tidewater for No. 1 X Foundry; $17 to $17.50 for No. 2 X Foundry, and $14.50 to $15 50 for Grey Forge at furnace.

Copper—The market for ingot has been steady, and sales light. Small sales of Lake have been made for 11 to 11¼ cents; other brands 10½ to 10¾ cents.

Lead—There has been a moderate demand for common pig, and rather large lots have sold at 3.70 cents.

Tin—The market for spot has been firm, with moderate demand. We quote, for jobbing lots, Banca 18 to 18¾ cents; Straits and Malacca, 17.50 to 17.60 cents.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—A situation as loam moulder. Address H. C., Am. Machinist.

Situation wanted by an iron foundry supt. or foreman. Address Iron Founder, Am. Machinist.

A competent mech. draftsman, well posted on general machine work and steam engines, wants situation. Address "Industrious" Am. Machinist.

Wanted—Situation as foreman of boiler shop. Am thoroughly experienced on marine and stationary boilers. References. Address F., Am. Machinist.

Mechanical engineer desires situation as superintendent or head draftsman. Will give references. Address R. L. C., Am. Machinist.

Wanted—Situation by an iron foundry foreman with some live iron works. Address Moulder, Am. Machinist.

Wanted—Position as foundry foreman. Practical abilities guaranteed. Address Iron & Brass, Am. Machinist.

Wanted—A steam fitter and machinist that understands bending pipe. Give experience and state wages expected. Columbus Iron Works Company, Columbus, Ga.

Having had years of experience in governing help, both male and female—am a good mechanic—would like a situation as foreman, or to take entire charge of a light manufacturing business. Address Experience, Am. Machinist.

Experienced mech. draftsman, with best references from present and former employers, is looking for a situation; would prefer printing press work, and like to go West. P. O. Box, 863, Woonsocket, R. I.

Wanted on the Pacific Coast, working foreman for machine shop; able to make his own drawings; well up in building horizontal and small marine engines; accustomed to sharp competition; good man can have good position; state salary required and full particulars as to qualifications. Address "Pacific," Am. Machinist.

To active, enterprising men agencies will be given for Kellam's Steam Damper and Pressure Regulators in New Haven, Hartford, Providence, Poughkeepsie, Albany, Syracuse, Rochester, Oswego, Buffalo, Pittsburgh, Titusville, St Louis, Richmond, Charleston, Savannah, Mobile, New Orleans. For particulars, address Hine & Robertson, 12 Cortlandt Street, N Y.

Wanted—Partner with nominal capital of $1,500 or $2,000, to take active interest in starting and operating boiler and machine shop Advertiser has a complete and valuable line of machinery and tools, adapted to both light and heavy work. To a capable man this is a chance such as is seldom offered Address "New York City" (Box 3), care Am. Machinist.

For sale very cheap, 30 x 30 x 16 ft. Iron Planer. Pond's make. Now in use in my shop. H. L. Shepard, Agent, 134 East 2d Street, Cincinati, O.

New patented lathe and drill press chuck; best in market. Holds drills from 3-32ds to largest size. Can be used for facing turned work from three inches down to smallest size. Now selling well, despite hard times, for $45. Inventor will sell patent. Address George Birkmann, 258 West 29th Street, N. Y. Top floor.

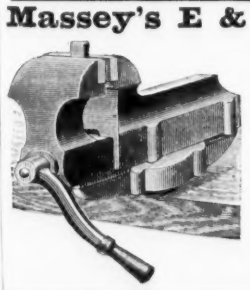
CHANDLER & FARQUHAR,
GEARS
168 Devonshire St., BOSTON, MASS.
Of all kinds in Stock and Made to Order.
Estimates Furnished for Models or Light Machine Work.
Tools and Supplies for Machinists and Manufacturers.
Send for Catalogue B.

BRADLEY'S HEATING FORGES.
ESTABLISHED 1832.

For Hard Coal or Coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.
BRADLEY & CO. Syracuse. N.Y
SPECIAL NOTICE.
All parties making, selling or using an Upright or Helve Power Hammer having a Cushioned Vibrating Saddle, infringe our patents, and we shall hold them legally liable for the same.
BRADLEY & COMPANY, Syracuse, N. Y.

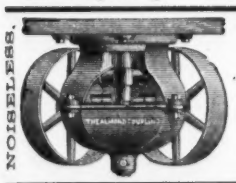
H.W.JOHNS'
ASBESTOS
PISTON PACKING
Our improved elastic Asbestos Piston Packing is composed of the best quality of pure Asbestos fibre, and forms the most perfect, compact, and durable Packing ever produced for locomotive, marine, and other engines, valve-stems, &c. It requires less oil than any other, being to a great extent self-lubricating and wears ten times as long as ordinary packings. It is proof against acids.
Asbestos Wick Packing,
Asbestos Mill Board,
Asbestos Gaskets and Rings,
Asbestos and Rubber Tape and Cloth.
Asbestos Boiler Coverings.
Our ASBESTOS CEMENT FELTING is the most effective and durable NON-CONDUCTING COVERING for STEAM PIPES, BOILERS, STILLS, and other Steam-Heated Surfaces. It is composed of Asbestos fibre and a cementing compound, which forms a light, porous Covering, partaking of the nature of a Felt and a Cement. It can be easily applied by any one.
Asbestos Hot Blast Cement Felting,
Asbestos Air Chamber Covering,
Asbestos Locomotive Lagging,
Asbestos and Hair Woven Felt.
We also manufacture Asbestos Cloths, Asbestos Cord, Twine, Yarn, and Sewing Twine, Asbestos Sheathing, Asbestos Paper, Asbestos Gasket and Retort Cements, Sheathing Felts, Etc., also the Standard
ASBESTOS ROOFING, LIQUID PAINTS, PURE COLORS ETC.
Descriptive Price List and Samples free.
H. W. JOHNS MFG. CO.
87 Maiden Lane, New York.
175 Randolph St., Chicago. 170 N. 4th St., Philadelphia.
Billiter House, Billiter Street, London.

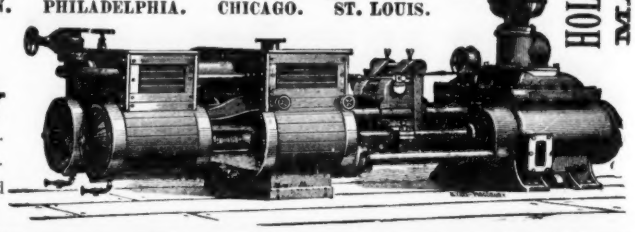
THE BROWN HAMMER
STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer
A NEW MOVEMENT! SEND FOR DESCRIPTION
KNOWLTON MFG. CO., King St., Rockford, Ill.

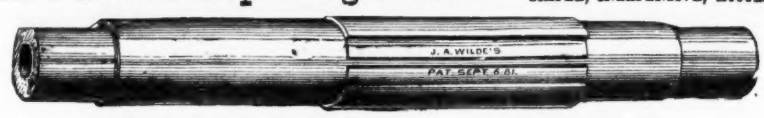
Massey's E & K Patent
VISES.

NO LOST MOTION.
Simply constructed, convenient and durable.
T. C. MASSEY,
Sole Manufacturer,
15 S. Jefferson St., CHICAGO, ILL.
Eastern Depot,
LINK BELT CO.
81 John St., N. Y.
Write for Description.

STEPHENS PATENT
PLANER CHUCKS

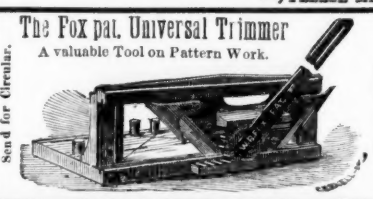
Combine valuable features offered by no other tool. Its range of opening; advantage of self-adjusting jaw worked by a single screw; graduated base, etc. Parts interchangeable. Chucks guaranteed. Sold by the trade. Send for Catalogue.
Self-Adjusting.
MELVIN STEPHENS, Prop'r, Office, 41 Dey Street, New York.

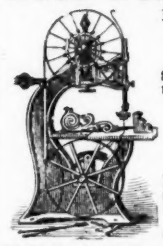
NOISELESS.

The Almond Coupling.
A new quarter turn motion to replace quarter turn belts and bevel gears.
T. R. ALMOND, Mfr.,
83 & 85 Washington Street, BROOKLYN, N. Y.

The Deane Steam Pump Co., HOLYOKE, MASS.
NEW YORK. BOSTON. PHILADELPHIA. CHICAGO. ST. LOUIS.
MANUFACTURE
PUMPING MACHINERY
FOR ALL DUTIES.
Send for New Illustrated Catalogue.


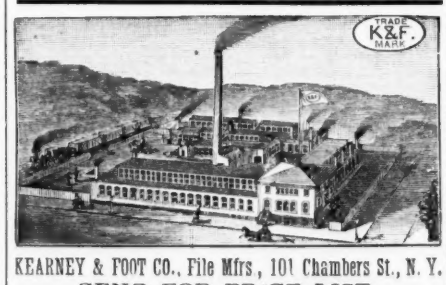
Wilde's Patent Expanding Mandrel Is the Most Perfect Novelty out. SIMPLE, INEXPENSIVE, ACCURATE.


COOKE & CO., 22 Cortlandt Street, NEW YORK,
Sole Agents and Dealers in General Machinery and Supplies.
—) PLEASE MENTION THIS PAPER. (—

The Fox pat. Universal Trimmer
A valuable Tool on Pattern Work.
CUTS SQUARE, or ANY ANGLE. Send for Circular.

W. R. FOX, Grand Rapids, Mich.

J. A. FAY & CO. CINCINNATI, Ohio, U.S.A.
BUILDERS OF IMPROVED
WOOD-WORKING MACHINERY

Embraces nearly 400 Machines for
Planing and Matching,
Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, etc.
Variety and Universal
WOOD WORKERS.
Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc.
All of the highest standard of excellence.
W. H. DOANE, Pres't. D. L. LYON, Sec'y.

STEAM ENGINE FOR SALE.
Second-hand, plain horizontal, Cylinder, 16x36, with cut-off valve and main valve, brass on main bearings; crank shaft, 8in.; fly-wheel, 14 feet, with 24in. fall, with governor complete. Will be sold for reason it is not large enough for use now required. Price, where it stands (in this city), $800. A great bargain. For further particulars, call and see, or address,
D. P. PACE,
Buffalo, N.Y.



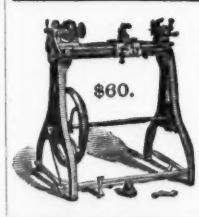
KEARNEY & FOOT CO., File Mfrs, 101 Chambers St., N. Y.
SEND FOR PRICE LIST.

The Fireman's Guide.
A Handbook on the
CARE OF BOILERS
By KARL P. DAHLSTROM, M. E.
Crown 8vo, Cloth, 50 Cents.
E. & F. N. SPON, 35 Murray St., New York.

FOR SALE AT A BARGAIN
A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock. The business will be carried on until sold. Address
A. FALKENAU, Leadville, Colo.,
Or 123 E. 72d St., New York City.
Only reason for selling, ILL-HEALTH.

Stationary
STEAM ENGINES.
Especially adapted to Electric Lighting Purposes—Treating of the Development of Steam Engines—the Principles of Construction and Economy, with description of Moderate Speed and High Speed Engines. By Prof. Robt. H. Thurston, 8vo, cloth, $1.50.
JOHN WILEY & SONS, 15 Astor Place, NEW YORK,
Publishers of Industrial Works.
, Mailed and prepaid on the receipt of the price.

CALDWELL'S
"One" AND "Two Speed"
CHAIN HOISTS.
Our "Two Speed" is the only machine of its kind. Size for size, these hoists are lighter, and cost no more, than other makes.
The above is *one* of our specialties. Send for hoist circular. We **Design, Construct** and **Furnish** all kinds of steam and motive plant.
New York Engineering Co.
64 Cortlandt St., N. Y.



Sebastian, May & Co.'s
Improved Screw Cutting
FOOT or POWER LATHE.
14"x40", 6' bed, price $175.
Catalogue of Lathes Drill Presses and Machinists Tools and Supplies. Mailed on application. Lathes on Trial.
136 & 138 W. Pearl St., Cincinnati, O.

Established in 1874.
CLEVELAND TWIST DRILL CO.
24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.
JAS. HUNTER & SON, North Adams, Mass.

STANDARD TOOL CO., Cleveland, Ohio. W. A. BABCOCK. Manager.

FOR SECOND-HAND PLANING MACHINE SALE
To plane 50 inches wide, 46 inches high, and 28 feet long; arranged to widen out to 70 inches. Ready for delivery Sept. 1st, and until that time can be seen running in our works This machine is in good order, and will be sold at a bargain, Apply to
BETT'S MACHINE CO., Wilmington, Del.

JUST PUBLISHED!
New and Complete Illustrated Catalogue
OF
BLAKE'S IMPROVED STEAM
PUMPING MACHINERY.
SEND FOR A COPY.
ADDRESS,
GEO. F. BLAKE MANUFACTURING COMPANY
95 & 97 LIBERTY STREET, NEW YORK. | 44 WASHINGTON STREET, BOSTON.

NICHOLSON FILE CO.,

SOLE MANUFACTURERS OF

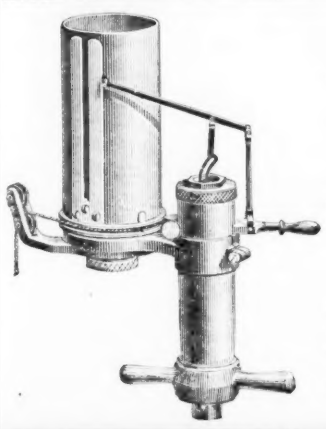
FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS AND SPECIALTIES.

"Nicholson File Co's" Files and Rasps, "Double Ender" Saw Files, "Slim" Saw Files, "Racer" Horse Rasps, Handled Rifflers, Machinists' Scrapers, File Brushes, File Cards, Surface File Holders, Vise File Holders, Stub Files and Holders, Improved Butchers' Steels.

Manufactory and Offices at PROVIDENCE, R. I., U. S. A.



TESTIMONIAL

ON THE MERITS OF THE

TABOR INDICATOR.

Office B. W. Payne & Sons, Elmira, N. Y.

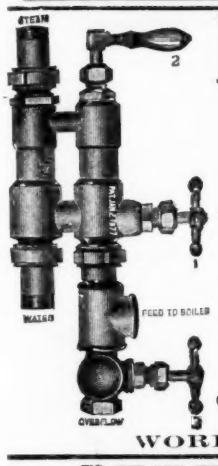
ESTABLISHED 1840.

BUILDERS PORTABLE, SEMI-PORTABLE & STATIONARY AUTOMATIC ENGINES.

The Ashcroft Manufacturing Co.,
111 Liberty Street, New York.

Gentlemen—In relation to Indicators we would say that we have had in frequent use during the past year a pair of your **Tabor Indicators** and a pair of Crosby instruments. *We prefer the Tabor*, as the diagrams are much more satisfactory than those from the Crosby. Very respectfully,

(Signed), B. W. PAYNE & SONS.



THE HANCOCK INSPIRATOR.

THE STANDARD

BOILER FEEDER FOR ALL CLASSES OF BOILERS.

OVER 70,000 IN USE.

Send for Circulars and Price Lists.

THE HANCOCK INSPIRATOR CO.,

OFFICE, 33 INDIA WHARF, BOSTON, MASS.

WORKS, BALDWIN STREET, BOSTON.

STEEL CASTINGS

From 1-4 TO 15,000 lbs. WEIGHT.

True to Pattern, sound, solid, free from blow-holes and of unequaled strength.

Stronger and more durable than iron forgings in any position or for any service whatever.

20,000 CRANK SHAFTS and 15,000 GEAR WHEELS of this steel now running prove this.

Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives.

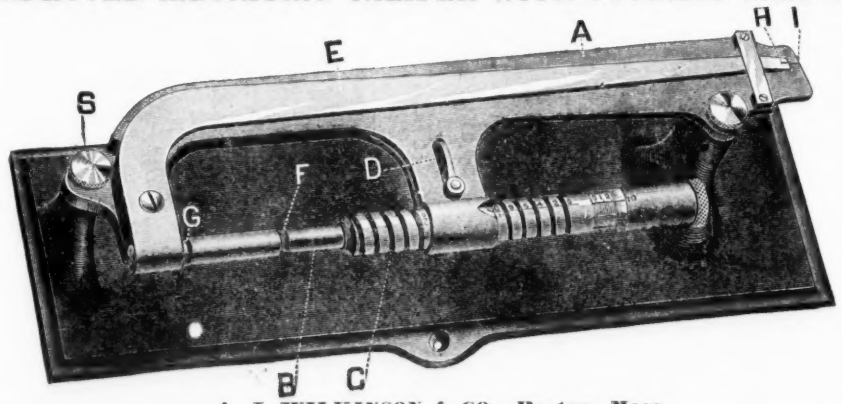
STEEL CASTINGS of every description.

Send for Circulars and Prices to

CHESTER STEEL CASTINGS CO.,

Works, Chester, Pa. Office, 407 Library St., Philada., Pa.

IMPROVED INDICATING CALIPER WITH COVERED SCREW.



A. J. WILKINSON & CO., Boston, Mass.

Makers of the Improved Indicating Caliper, designed and used as a STANDARD TEST GAUGE in GUN, PISTOL, WATCH FACTORIES, &C. Send for Illustrated Catalogue.

BOUND VOLUMES OF THE AMERICAN MACHINIST

for 1880, 1881, 1882, 1883 and 1884, cloth, $3.50 each, purchasers paying express charges.

Am. Machinist Pub'g Co., 96 Fulton St., New York

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK

NOTICE OF SALE.

Having disposed of my patents, drawings, patterns, tools, goodwill and everything connected with my milling machine business to the BROWN & SHARPE MFG. CO., of Providence, R. I., I refer further orders and inquiries to them.

Thanking the public for past favors, I am very respectfully,

March 10, 1885. C. E. LIPE, Syracuse, N. Y.

THE GARDNER GOVERNOR.

Over 30,000 in use.

Adapted to every style of stationary and portable steam engine.

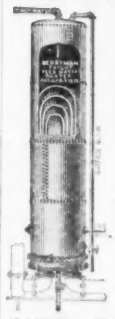
Warranted to give satisfaction or no sale.

For circulars and prices, address,

The Gardner Governor Co.,

QUINCY, ILL.

The BERRYMAN Patent



FEED WATER Heater & Purifier,

MANUFACTURED BY

I. B. Davis & Son, Hartford, Conn.

This heater has been in constant use over ten years. None have ever required repairs. Gives the highest results attainable by the use of exhaust steam

BENJ. F. KELLEY, Agent,

91 LIBERTY ST., NEW YORK.

Philadelphia Office:

JAMES BERRYMAN, 125 N. Fourth St.

REDUCED PRICE LIST OF

South Norwalk, CONN.

February 1st 1885.

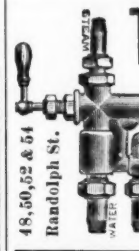
LE COUNT'S LATHE DOGS.

From this date the Prices of LeCount's Lathe Dogs will be as follows:

REDUCED PRICES OF

LE COUNT'S MALLEABLE IRON LATHE DOG.

No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	3/8	$0.30	8	2	$1.00
2	1/2	.30	Small Set of 8,		4.50
3	3/4	.40	9	2 1/2	1.20
4	1	.40	10	3	1.30
5	1 1/4	.60	11	3 1/2	1.40
6	1 1/2	.66	12	4	1.60
7	1 3/4	.90	Full Set of 12,		10.00



THE DUPLEX INJECTOR

THE BEST BOILER FEEDER KNOWN.

48, 50, 52 & 54 Randolph St.

Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot. Will feed water through a heater. Manufactured and for sale by

JAMES JENKS & CO.,
Detroit, Mich.

CYLINDER TALLOW. FREE OF ACID.

A. H. VAN CLEVE, Gen'l Purchasing Ag't, Camden & Amboy R. R. & Transportation Co. wrote from South Amboy, January 22, 1872: L. M. ELKINTON has furnished the United Companies of New Jersey, since March, 1869, and during 1870 and 1871, over 170,000 pounds **CYLINDER TALLOW** which has given the Motive Power Department and Steamboat Machine Department entire satisfaction.

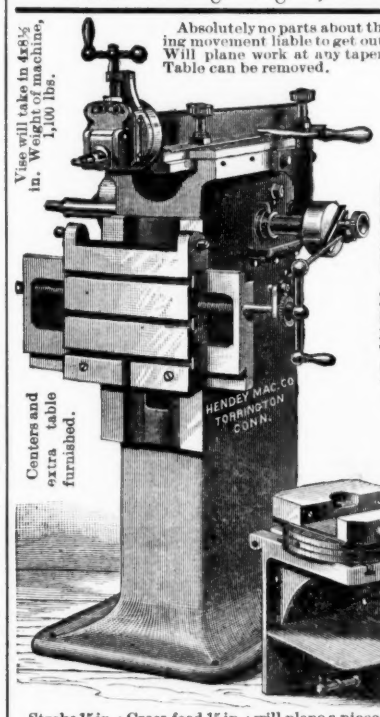
I believe Mr. Elkinton's Tallow to be free from the acids so destructive to Steam Cylinders and Valves, which is generally found in the tallow usually offered for sale in the market.

LINDLEY M. ELKINTON, Manuf'r,
532 St. John St., Philadelphia

WATER WORKS MACHINERY

A SPECIALTY.

Correspondence Solicited. Pond Engineering Co., St. Louis, Mo.

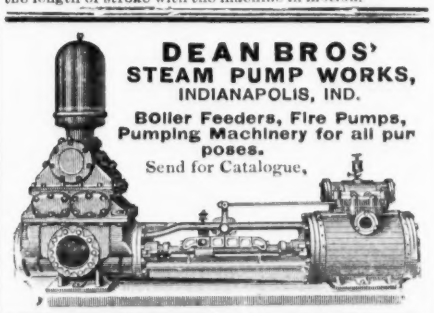


Absolutely no parts about this reversing movement liable to get out of order. Will plane work at any taper desired. Table can be removed.

15-INCH SHAPER.

THE HENDEY MACHINE COMPANY,
TORRINGTON, CONNECTICUT.

Stroke 15 in.; Cross-feed 15 in.; will plane a piece 12 inches high. Adapted to tool making and die work. New reversing movement, has perfect accuracy of stroke with the certainty of a crank machine, and the advantage of changing the length of stroke with the machine in motion.



DEAN BROS'
STEAM PUMP WORKS,
INDIANAPOLIS, IND.

Boiler Feeders, Fire Pumps, Pumping Machinery for all purposes.

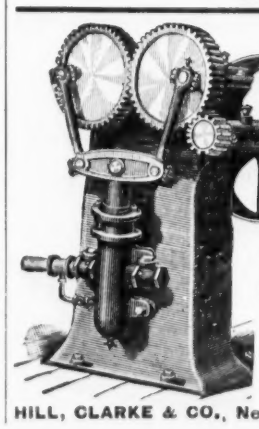
Send for Catalogue,

SEND FOR LIST

—OF—

Finished Iron Pulleys @ 4 cents per pound.
Rough " " @ 2½ " " "

THE JOHN T. NOYE MANUF'G CO.,
BUFFALO, N. Y.



The Nagle Force Pump

A New & Superior Mechanism.

All Joints Accessible and Adjustable.

Cut Gears, Straight-way Valves, Adjustable Feed.

MADE BY

A. F. NAGLE,

Office, 115 MONROE ST.,

CHICAGO, ILL.

HILL, CLARKE & CO., New England Agents.

SHAPING MACHINES

For Hand and Power, 6", 8" and 10" Stroke.

Adapted to All Classes of Work to their Capacity.

CIRCULARS FURNISHED.

BOYNTON & PLUMMER,

Worcester, Mass.

ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents wanted. T. NEW, 32 John Street, New York

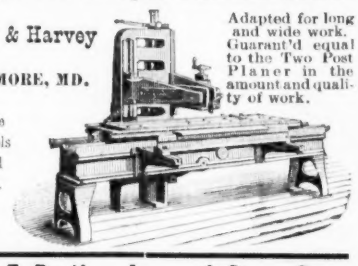
---

The Single Post or Open Side Iron Planer.

Detrick & Harvey

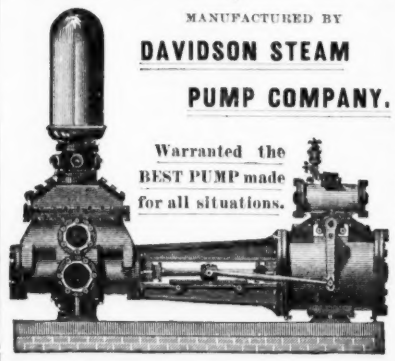
BALTIMORE, MD.

Manufacture Machine Tools and Special Machinery.



Adapted for long and wide work. Guarant'd equal to the Two Post Planer in the amount and quality of work.

The M. T. Davidson Improved Steam Pump,



MANUFACTURED BY

DAVIDSON STEAM PUMP COMPANY.

Warranted the BEST PUMP made for all situations.

PHILADELPHIA AGENT:
DANIEL KELLY, 51 N. Seventh St.

Principal Office, 77 Liberty St., New York.

"The Only Perfect"

BUFFALO PORTABLE FORGES.

The Lightest, Strongest, most durable, easiest working, and in every way

THE BEST Portable Forge MADE.

Buffalo Forge Co.,

Buffalo, N. Y.

WORTHINGTON INDEPENDENT CONDENSER.

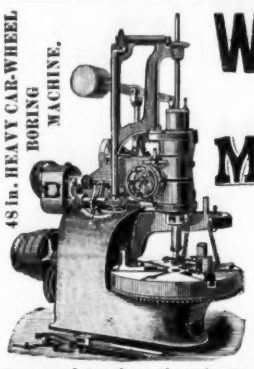
Henry R. Worthington,

NEW YORK.

Boston, Pittsburgh, Chicago, Cincinnati, Cleveland, St. Louis, San Francisco.

Send for Illustrated Catalogue.

48 in. HEAVY CAR-WHEEL BORING MACHINE.



WM. B. BEMENT & SON,

Philadelphia, Pa.

MANUFACTURERS OF

METAL WORKING MACHINE TOOLS

of all descriptions and a great number of sizes, including

A LARGE LINE OF SPECIAL TOOLS FOR RAILWAY PURPOSES.

Table is double-geared, has eight speeds, and runs on an inner and outer curved surface, affording solid support and continual self-adjustment. Spindle has 21 in. traverse, six automatic feeds, rapid hand movement, and concentric adjustment for wear at both ends of bearing. Power crane arranged to place the wheels centrally over the table, without swinging under the frame itself.

ENGINE ★ LATHES, ★ HAND ★ LATHES

Slide Rests and Planer Centers.

WOOD-WORKING MACHINERY

For Planing Mills, Furniture, Chair and Cabinet Factories, Cabinet Works and General Wood-Working. Send Stamp for Illustrated Catalogue to

ROLLSTONE MACHINE CO.
45 Water St.,
FITCHBURG, MASS., U.S.A.

GRANT MACHINE TOOL WORKS,

Flushing, N. Y.

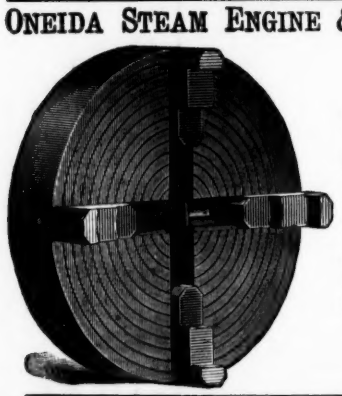
JOHN J. GRANT, PROPRIETOR.

Manufacturer of

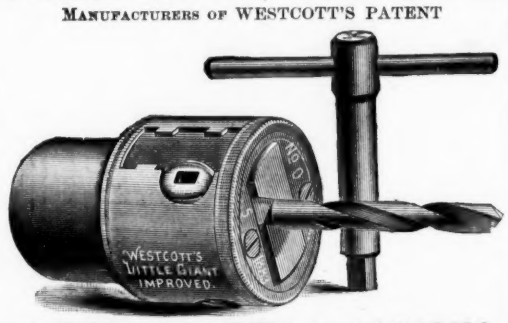
FIRST-CLASS MACHINE TOOLS.

ONEIDA STEAM ENGINE & FOUNDRY COMPANY, - ONEIDA, N. Y.

MANUFACTURERS OF WESTCOTT'S PATENT



NEW CATALOGUE READY.



LATHE and DRILL CHUCKS.

THOS. H. DALLETT & CO.,

No. 8 N. 21st St., Philadelphia, Pa.

Manufacturers of

PATENT

Portable Drilling Machines

VERTICAL DRILLS,
Radial Drills, Multiple Drills,
HAND DRILLS.

New Illustrated Catalogue just issued.

BINDERS FOR THE AMERICAN MACHINIST, $1.00 BY MAIL.
96 FULTON STREET, N. Y.

Stow Flexible Shaft Co.

(LIMITED)

15th & Penna. Ave.

PHILADELPHIA.

Manufacturers of

PORTABLE

Tapping, Reaming

—AND—

Boring Machines.

TOOLS for Emery Wheel Grinding, Metal and Wood Polishing and Horse and Cattle Brushing and Clipping.

THE

Slate Sensitive Drill

Adapted to rapid work with small drills. Its extreme sensitiveness prevents clogging and breakage of drills. Has a swinging table with attachment for center drilling. Instantly adjustable to different lengths of work. Over 200 already in use. Send for Circular.

DWIGHT SLATE,
Hartford, Conn.

ELEVATORS

With Screw or Spur Gear, operated with belts or hand; Automatic Hatch Doors; Hydraulic or Steam Elevators or Hoists.

GEO. C. HOWARD,

19 S. 18th St., Phila. 12 Cortlandt St., N. Y

CRANK PLANERS

Superior Design & Workmanship, Extra Heavy (1500 lbs.)
—DOWN, ANGULAR AND CROSS-FEED,—
TO PLANE 12x16x15.
R. A. BELDEN & CO., DANBURY, CT.

—THE—

Hartford Drill Chuck

contains the maximum of power, durability and efficiency, and is fully guaranteed. No. 1 holds from 0 to 1/4", price $7. No. 2 (round body) holds from 0 to 3/4", price $8. Sold by the trade.

Address,

A. F. CUSHMAN,
HARTFORD, CONN.

Manufacturer of all kinds of Chucks.
Send for new Illus'd Catalogue.

TACK & SHOE MACHINERY

SWEETSER & MERRITT,
BROCKTON, MASS.

S. ASHTON HAND MFG. CO.,

Toughkenamon, Chester Co., Pa.

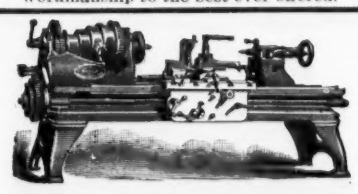
MAKERS OF FIRST-CLASS

ENGINE ✣ LATHES

Are now in position to put on the market

14" ENGINE LATHES of NEW DESIGN

guaranteed to be equal in material, design and workmanship to the best ever offered.



NEW HAVEN MANFG. CO.,

New Haven, Conn.

IRON - WORKING MACHINERY,

Planers, Shapers, Drills, Slotters, &c.

ABSOLUTELY SAFE FROM EXPLOSION — DESTRUCTIVE — BOILERS — ECONOMICAL — DRY STEAM — WORN PROVED — 18 YEARS RECORD

BOILERS READILY ENLARGED STATIONARY OR PORTABLE. IMMEDIATE DELIVERY.

CORRESPONDENCE SOLICITED.
HARRISON SAFETY BOILER WORKS,
GERMANTOWN JUNC. PHILA. PENNA.

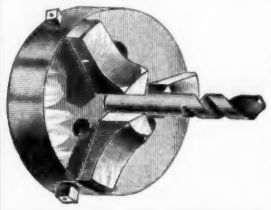
GENERAL AGENTS
GRAYDON & DENTON, Affiliated
No. 1 PARK PLACE, NEW YORK.

ESTABLISHED 1851.

The Horton Lathe Chuck,

ALSO

CHUCKS



for Brass Finishers' Use, Milling Machines, Screw Machines, Upright Drills, Cutting-Off Machines, Drill Lathes, and for Boring Mills for Car Wheel and other work.

THE E. HORTON & SON CO.

Canal St., Windsor Locks, Conn., U. S. A.

THE STANDARD REVOLUTIONS COUNTER

Ulster Machine Co.
E. D. WILLIAMS, Pres't.

Send for Circular.
Box 1488.
Providence, R. I.

PAT. STOP MOTION.

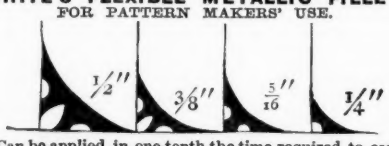
Registers 2,000 Revolutions.

CURRIER & SNYDER,

Upright Drills,

WORCESTER, MASS.

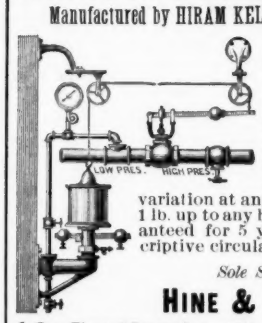
WHITE'S FLEXIBLE METALLIC FILLET,
FOR PATTERN MAKERS' USE.



Can be applied in one-tenth the time required to carve curved fillets. Send for sample. H. B. Smith Machine Co., Mfrs. of Wood Working Machinery, 925 Market St., Phila.

KELLAM'S STEAM PRESSURE REGULATOR

Manufactured by HIRAM KELLAM, Detroit, Mich.

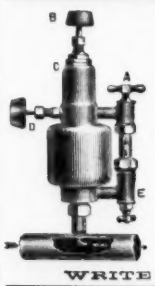


Different from any other regulator, its working parts having no springs, packing, diaphragm, or stuffing box, insuring promptness of action and great durability. Regulates pressure without perceptible variation at any point desired, from 1 lb. up to any boiler pressure. Guaranteed for 5 years. Send for descriptive circular.

Sole Sales Agents:

HINE & ROBERTSON,
12 Cortlandt St., New York.

P. BLAISDELL & CO.
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.



CRAIC'S

New "Class C" Lubricator

Manufactured by
The Craig Sight Feed Lubricating Co.
LAWRENCE, MASS.

Manufacturers of

Sight Feed Lubricators for Locomotives, Stationary, Marine, Portable & Pumping Engines.

WRITE FOR CIRCULAR.

FORBES & CURTIS,

BRIDGEPORT, CONN.

Manufacturers of

The Forbes Pat. Die Stocks,

Power Pipe Cutting and Threading Machines, Cutting-off Machines, Ratchet Drills, Special Machinery, etc., etc.

WRITE FOR CATALOGUE. Mention Paper.

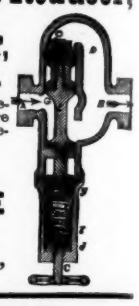
Ross Fluid Pressure Reducer,

FOR

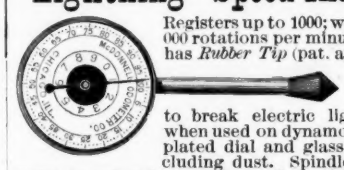
Steam, Water, Air and Gas.

Automatically reduces the pressure in pipes to any desired extent.

ROSS VALVE CO.,
652 RIVER ST.,
TROY, N. Y.



"Lightning" Speed Indicator



Registers up to 1000; will stand 10,000 rotations per minute. Spindle has *Rubber Tip* (pat. app'd for) to prevent slipping, and also to break electric light current when used on dynamo. Has silver plated dial and glass crystal, excluding dust. Spindle, 1/8", 1" 2" or 3", as ordered. Sent by mail for **$2.50.** Discount to dealers.

J. H. WALLACE, General Agent,
25 MAIDEN LANE, N. Y.

BARNES'

Patent Foot Power Machinery. Complete Outfits for actual workshop business. With them Builders, Cabinet Makers, Metal and Wood Workers compete with steam power. Machines **on trial** if desired. Proof of value, prices, full detail, illustr'd catalogue, free.

W. F. & John Barnes Co.
Rockford, Ill.
Address No. 1995 Main St.

FAY & SCOTT, Dexter, Me.

MANUFACTURERS OF

WOOD LATHES,

Drill Lathes, Shaping Machines, Milling Machines, Planer Centers, &c.

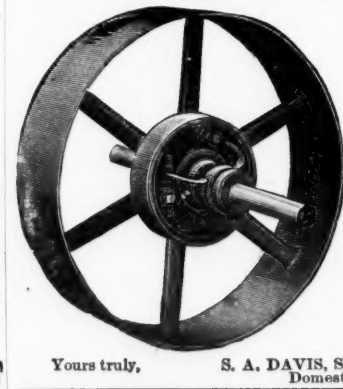
SEND FOR CATALOGUE.

NO LIMIT TO CIRCLE DRAWN.

MACHINISTS LABOR SAVING TOOLS
G & W THREADING TOOLS OLD & NEW.
WOODBRIDGE LATHE & PLANER TOOLS. 3 SIZES.
STEEL "KNIFE EDGE" STRAIGHT EDGES.
BORING & INSIDE THREADING TOOLS.
JOHNSON'S CUTTING OFF TOOLS FOR LATHE & PLANER. SEND FOR CIRCULAR.
THE HARTFORD TOOL CO. HARTFORD CONN.

Office THE DOMESTIC MFG. CO.,
Newark, N. J., Sept. 18, 1884.

Mr. JOHN C. BLEVNEY, Pres.,
The Blevney Mfg. Co., Newark, N. J.



Dear Sir: We have had two of your friction clutches running on one of our screw machines for the last six months and I am satisfied that they are the best thing we have ever had in that direction; It gives us no trouble whatsoever and we intend to put them in as we require to change.

Yours truly, S. A. DAVIS, Supt.,
Domestic Mfg. Co.

BEVEL GEARS,

Cut Theoretically Correct.

For particulars and estimates apply to

BREHMER BROS.,
Machinists,
440 N. 12th St., Philadelphia, Pa.

FOX AND TURRET

SPEED ✣ LATHES.

BRASS FINISHERS' TOOLS.

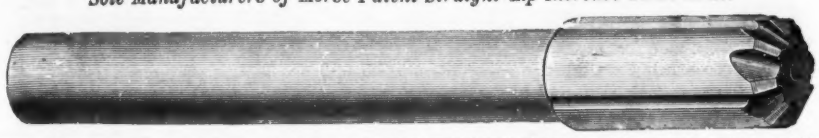
GEO. GAGE, WATERFORD, N. Y.

E. P. BULLARD, Ag't., 14 Dey St., NEW YORK.

J. H. WILLIAMS & CO.
COR. RICHARDS & BOWNE STS. (NEAR HAMILTON FERRY) BROOKLYN, N.Y.
IRON AND STEEL
DROP FORGINGS
OF THE BEST QUALITY.
NEW BUILDINGS & MACHINERY ESPECIALLY ADAPTED FOR THE BUSINESS
ESTIMATES GIVEN ON RECEIPT OF MODELS.

MORSE TWIST DRILL AND MACHINE COMPANY, NEW BEDFORD, MASS.

Sole Manufacturers of Morse Patent Straight-Lip Increase Twist Drill.



SOLID AND SHELL REAMERS, BEACH'S PATENT SELF-CENTERING CHUCK, BIT STOCK DRILLS.

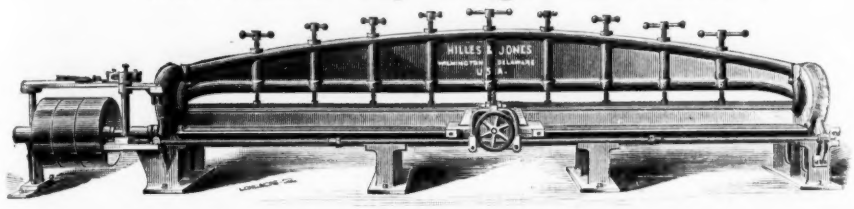
Drills for Coes, Worcester, Hunter and other Hand Drill Presses. Drill Grinding Machines, Center and Adjustable Drill Chucks, Taper Reamers, Milling Cutters, and Special Tools to order.

ALL TOOLS EXACT TO WHITWORTH STANDARD GAUGES.

GEO. R. STETSON, Sup't. EDWARD S. TABER, Pres't and Treas.

BOILER PLATE PLANER.

Will Plane any Length of Plate.

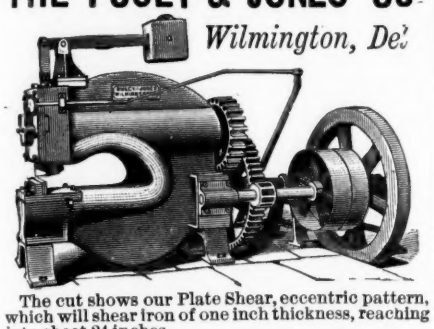


Tools cut both ways and have independent adjustment. Table acts as a gauge for setting the Plate. Driven by a Steel Screw, which is supported its entire length so that it cannot be bent or sprung.

HILLES & JONES, Wilmington, Del.

THE PUSEY & JONES CO.

Wilmington, Del.

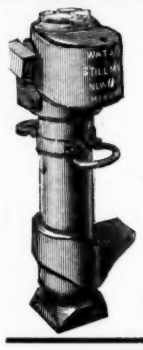


The cut shows our Plate Shear, eccentric pattern, which will shear iron of one inch thickness, reaching into sheet 24 inches.

BUILDERS OF STEAM ENGINES,

Boilers, Tanks, Machinery for Rolling Mills, Punches, Shears, Riveters, Angle Iron Cutters, Cranes and heavy Iron Work generally.

Watson & Stillman,



468 Grand St., New York,

MANUFACTURERS OF

Hydraulic Jacks & Punches
[Improved 1884.]

Hydraulic Presses, Pumps and Fittings.

Lever and Screw Punches and Shears.

Polishing and Buffing Machinery, Wheels, &c.

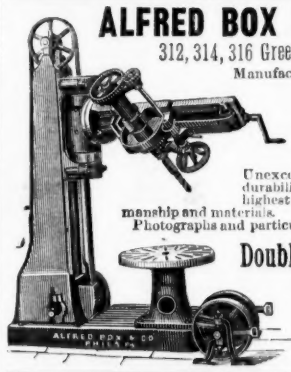
ALFRED BOX & CO.,

312, 314, 316 Green St., Philad'a, Pa.

Manufacturers of

UNIVERSAL

Radial Drills,



Unexcelled for simplicity, durability, solidity. The highest standard of workmanship and materials. Photographs and particulars furnished.

Double Screw Hoist

Traveling Cranes, &c.

Send for New Catalogue.

J.S.GRAHAM & CO.

J.S. GRAHAM — JOHN KANE

TRADE MARK

WOOD WORKING MACHINERY

SEND FOR CATALOGUE. FACTORY ST. ROCHESTER, N.Y.

VOLNEY W. MASON & CO.,

Friction Pulleys, Clutches and Elevators,

PROVIDENCE, R. I.

HALL'S PATENT

Automatic Injectors.

For supplying all classes of steam boilers with water. We guarantee these Injectors to be the best, simplest and only thoroughly reliable Boiler Feeders in the world, working from 2 lbs. to 200 lbs. steam pressure.

HALL'S Engineering CO.,

112 JOHN ST., NEW YORK.

The Waterbury Farrel Foundry & Machine Co.

WATERBURY, CONN.

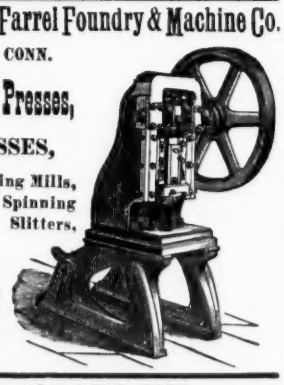
Patent Power Presses,

DROP PRESSES,

Foot Presses, Rolling Mills, Rivet Machines, Spinning Machines, Gang Slitters,

Special Machinery

for Sheet Metal, Wire, Etc.



J. C. HOADLEY,

CIVIL AND MECHANICAL ENGINEER

and Expert in Patent Causes,

28 STATE STREET, ROOM 28, BOSTON, MASS.

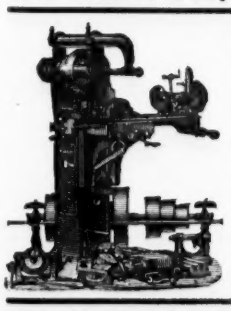
MACHINERY

For Reducing and Pointing Wire.

Especially adapted to pointing wire rods and wire for drawing.

For Machines or information, address the manufacturer,

S. W. GOODYEAR, Waterbury, Ct.



Contracts solicited for Special Machines, Patent Devices, &c., in quantity.

Complete outfit for Machinists, Blacksmiths, Metal-Workers and others.

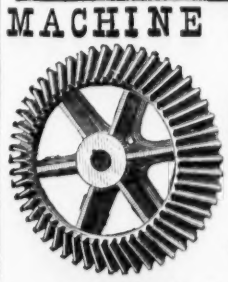
New Circular on Milling Machine and Universal Head (Pat. Pending.)

THE CINCINNATI SCREW & TAP CO.

S. E. Cor. Pearl & Plum Streets,

CINCINNATI, OHIO.

MACHINE MOULDED Spur and Bevel GEARS



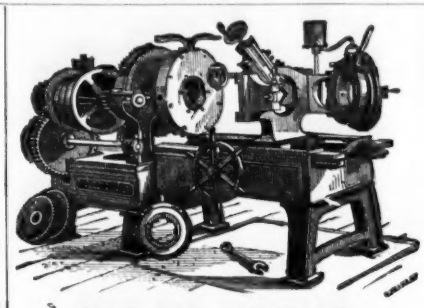
Pulley Castings, &c.

Special Inducements to the Trade.

LIST MAILED ON APPLICATION.

POOLE & HUNT,

BALTIMORE, MD.



SEND FOR CIRCULAR.

D. SAUNDERS' SONS,

Manufacturers of

Pipe Cutting & Threading Machines

For Pipe, Mill and Steam Fitters' Use.

TAPPING MACHINES,

For Steam Fitting, also

Steam and Gas Fitters' Hand Tools.

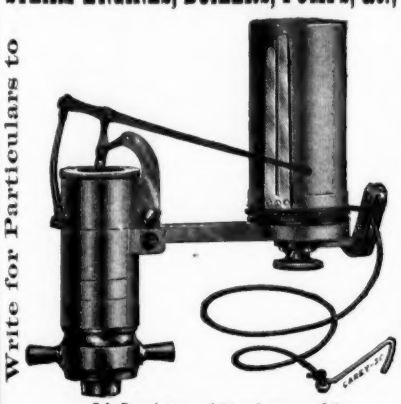
YONKERS, N. Y.

CROSBY STEAM GAGE AND VALVE CO.

Manufacturers of INSTRUMENTS for Use on

STEAM ENGINES, BOILERS, PUMPS, &c., &c.

Write for Particulars to 95 & 97 Oliver Street, Boston, Mass.



Sole Proprietors and Manufacturers of the

CROSBY STEAM ENGINE INDICATOR.

—SPECIAL INDUCEMENTS TO ENGINEERS.—

"ECLIPSE" Pipe-Cutting Machines

FOR HAND OR POWER.

Don't you have sufficient Pipe-Work about your Mill, Factory, or Shops to make a powerful, convenient and very compact Pipe-Cutting Machine soon pay for itself, providing it could be had at a moderate price?

Mention this paper and write us for particulars.

PANCOAST & MAULE,
Philadelphia, Pa.

Made in Three Sizes, Cutting Pipes ¼ to 6 inch.

THE SCIENTIFIC PORTABLE FORGES, HAND AND «POWER» BLOWERS, EXHAUSTERS, ETC.

Decided improvements in this line of manufacture.

Send for Catalogue of different styles and sizes.

The Foos Mfg. Co.

SPRINGFIELD, O.

THE NEW PULSOMETER.

The cheapest, strongest, most simple, compact, durable, effective and economical Steam Pump in the market, for raising liquids under and up to 100 feet. No Machinery, No Oil, No Special Care. Can be worked suspended by a chain. Will pass grit, mud, sand, pulp, etc., without injury to its parts. Needs only a steam pipe from boiler to run it. Price, 600 gallons per hour, $50; 1,200 do. $75; 3,600 do. $100; 6,000 do. $150; 10,000 do. $175; 18,000 do. $225; 25,000 do. $275; 45,000 do. $40; 60,000 do. $500; 120,000 do. $1,000.

Write for illustrated descriptive book with testimonials, etc. Mailed free. PULSOMETER STEAM PUMP CO., 83 John St., New York.

Iron and Steel DROP FORGING

Of Every Description, at Reasonable Prices.

R. A. BELDEN & CO., DANBURY, CT.

PROGRESS MACHINE WORKS.

OFFICE 43 PARK PLACE WORKS 57, 59 AND 61 LEWIS ST. 60, 62, 64 & 65 Cannon ST. NEW YORK

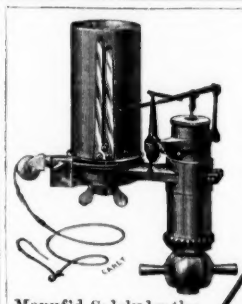
A. & F. Brown.

PULLEYS,

SHAFTING, HANGERS,

A Specialty.

Send for Ill. Price List and Discount Sheet.



Manuf'd Solely by the

American Steam Gauge Co.,

Boston, Mass.

SEE REFERENCE.

Engineers allowed special terms.

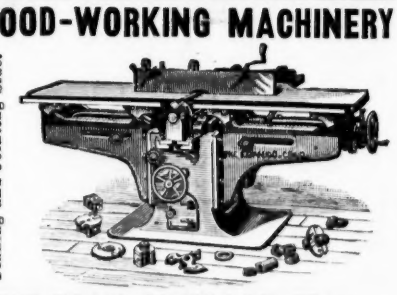
Office of PACIFIC IRON WORKS, BRIDGEPORT, CONN., March 14, 1884.

AMERICAN STEAM GAUGE CO. *Gentlemen*—Referring to the THOMPSON IMPROVED INDICATOR which we purchased of you last year, would say, that we have used it upon a great many high and low speed engines, both of our own and other builders' manufacture, and find it gives perfect results and much satisfaction, and in our opinion is the best Indicator yet offered to the public.

Yours very respectfully,
P. H. SKIDMORE & CO'S.
Pacific Iron Works.

WOOD-WORKING MACHINERY

New Universal Wood Worker, Planing and Jointing Side.



THE EGAN COMPANY, Mfrs.,

Successors to The Cordesman & Egan Co.,

201 to 221 WEST FRONT ST., CINCINNATI, OHIO.

Wells Bros. & Co.

GREENFIELD, MASS.,

Manufacturers of

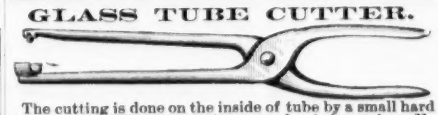
"New Little Giant,"

Screw Cutting Machinery & Tools.

Adjustable Dies, Fine Taps, &c.

Adjustable Die used in all our Screw Cutting Tools

GLASS TUBE CUTTER.



The cutting is done on the inside of tube by a small hard steel wheel. Will cut any size or grade of glass tube. No practice required to operate.

Price $2.50 each, (Discount to dealers.)

Manufactured by HUNT & CONNELL, (Limited.)

SCRANTON, PA.

THE EATON, COLE & BURNHAM CO.

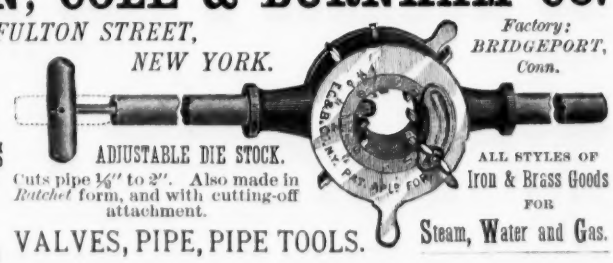
82 & 84 FULTON STREET, NEW YORK.

Factory: BRIDGEPORT, Conn.

MANUFACTURERS OF

Pipe Cutting and Threading Machines

OPERATED BY HAND OR POWER.

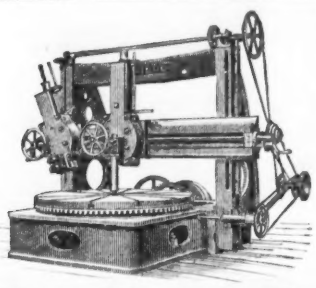


ADJUSTABLE DIE STOCK.

Cuts pipe ⅛" to 2". Also made in *Ratchet* form, and with cutting-off attachment.

ALL STYLES OF **Iron & Brass Goods** FOR **Steam, Water and Gas.**

FITTINGS, VALVES, PIPE, PIPE TOOLS.



WILLIAM SELLERS & CO.,

Philadelphia, Pa.

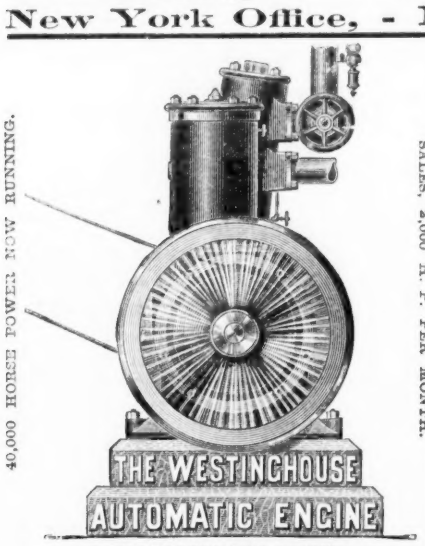
Machine Shop and Railway

EQUIPMENTS.

Shafts, Couplings, Hangers, Pulleys, Mill Gearing, etc., Lathes, Planers, Drills, Shapers, Bolt Cutters, Railway Turntables, and Pivot Bridges, Gifford Injectors, Sellers' Improvements, New Patterns, Simple, Effective.

New York Office, - No. 79 Liberty Street.

40,000 HORSE POWER NOW RUNNING.



SALES, 2,000 H. P. PER MONTH.

1,300 ENGINES NOW IN USE.

Send for Illustrated Circular and Reference List.

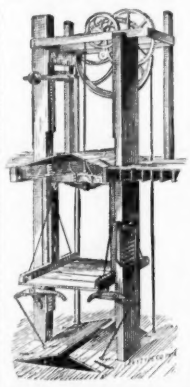
The Westinghouse Machine Co.,

PITTSBURGH, PA.

SALES DEPARTMENT CONDUCTED BY

WESTINGHOUSE, CHURCH, KERR & CO., 17 Cortlandt Street, New York.
FAIRBANKS, MORSE & CO., Chicago, Cincinnati, Cleveland, Louisville and St. Paul.
FAIRBANKS & CO., St. Louis, Indianapolis and Denver.
PARKE & LACY, San Francisco and Portland, Or.
PARKE, LACY & CO., Salt Lake City, Utah, and Butte, Montana.
D. A. TOMPKINS & CO., Charlotte, N. C.
KEATING IMPLEMENT & MACHINE CO., Dallas, Tex.
IMRAY & CO., Sydney and Melbourne, Australia.
R. ROGERS, 43 Rue Lafitte, Paris.
F. E. AVERILL, Delft, Holland.

Morse Elevator Works



Morse, Williams & Co.,

(Successors to Clem & Morse)

Builders of All Kinds of

PASSENGER and FREIGHT

Elevators

Office, 411 Cherry St.

Works, Frankford Ave., Wildey and Shackamaxon Sts.,

PHILADELPHIA.

New York Office, 108 Liberty St.

THE NATIONAL FEED WATER

HEATER

A brass coil heater supplying feed water at 210° to 212° Fahrenheit by use of exhaust steam.

Our prices are low and reasonable, and we aim to supply the *cheapest, best and most effective Heater in the market.* Fifteen sizes. No. 1, 8-horse Heater, $17. No. 10, 100-horse Heater, $150. Iron, Brass and Copper Coils and Bends made to order. Circulars and price lists sent on application.

National Pipe Bending Co.,

NEW HAVEN,

Connecticut.

WESTINGHOUSE, CHURCH, KERR & COMPANY,

CONSULTING AND CONTRACTING ENGINEERS,

17 Cortlandt St., - - - NEW YORK.

WE CONTROL THE EXCLUSIVE SALE OF

THE WESTINGHOUSE AUTOMATIC ENGINE,
THE REYNOLDS-CORLISS ENGINE,
THE HUYETT & SMITH FANS AND VENTILATING WHEELS,
THE AMERICAN PAPER PULLEY,
THE STERLING STEEL CO. Fine Tool Steels.

ALSO CONTRACTORS FOR

(Representing E. P. ALLIS & CO., Milwaukee, Wis.)

BLOWING ENGINES, PUMPING ENGINES, SEWERAGE PUMPS, & HEAVY MACHINERY.

CIRCULARS, PLANS, AND PRICES FURNISHED ON APPLICATION.

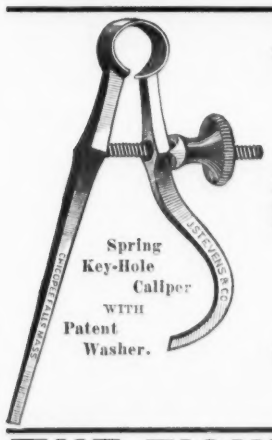
THE BEST IN THE WORLD.

We make the Best Packing that can be made regardless of cost. Users will sustain us by calling for the "JENKINS STANDARD PACKING."

Our "Trade Mark" is stamped on every sheet. None genuine unless so stamped. ☞ Send for Price List *A*.

JENKINS BROS.,

71 John St., N. Y. 79 Kilby St., Boston.



J. STEVENS & CO.,

P. O. BOX 1200,

Chicopee Falls, - Mass.,

MANUFACTURERS OF

Spring Caliper and Dividers,

FINE MACHINIST TOOLS AND FIRE ARMS.

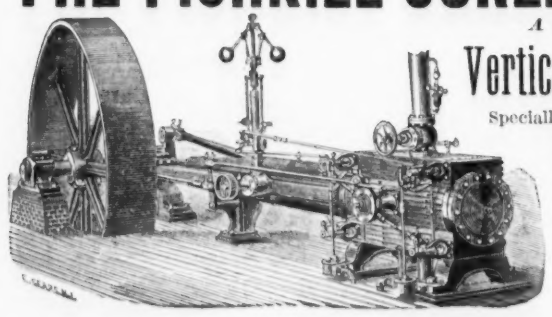
Our SHOOTING GALLERY RIFLE

IS THE FAVORITE EVERYWHERE.

SEND FOR ILLUSTRATED CATALOGUE.

THE FISHKILL CORLISS ENGINE,

A FULL LINE OF SIZES.



Vertical Condensing Engines

Specially adapted for and extensively used in large grain elevators.

BOILERS.

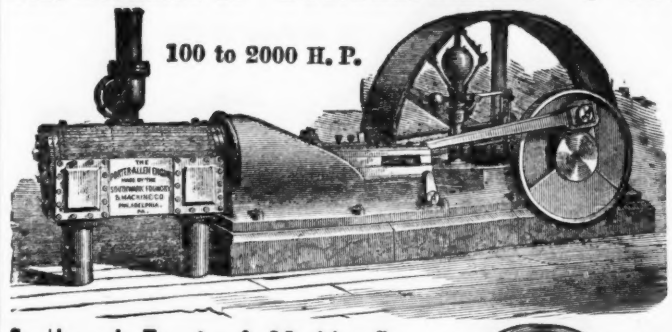
Manufactured by the

Fishkill Landing Machine Co.

FISHKILL-ON-THE-HUDSON, N. Y.

Send for Catalogue A, containing Illustrated Description and References.

Sole Builders of "PORTER-ALLEN" and "SOUTHWARK"



100 to 2000 H. P.

HIGH SPEED ENGINES.

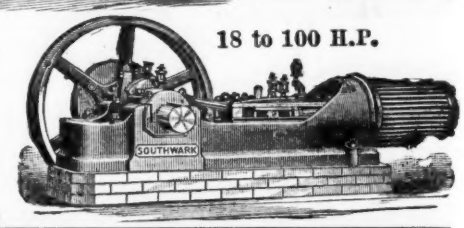
Southwark Foundry & Machine Co.,

430 WASHINGTON AVE.,

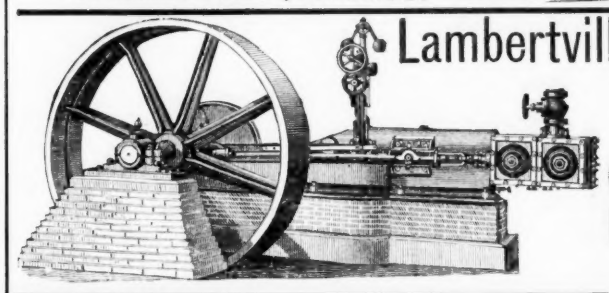
Philadelphia, Pa.

44 ASTOR HOUSE, NEW YORK.

154 LAKE STREET, CHICAGO.



18 to 100 H.P.



Lambertville Iron Works,

MANUFACTURERS OF

PATENT AUTOMATIC CUT-OFF

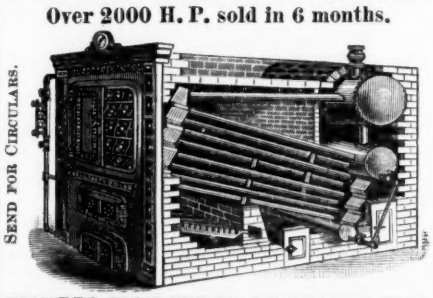
Steam Engines

LAMBERTVILLE, N. J.

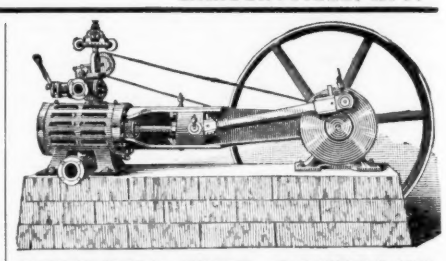
ZELL SAFETY WATER TUBE BOILER.

Over 2000 H. P. sold in 6 months.

SEND FOR CIRCULARS.



PIONEER IRON WORKS, BROOKLYN, N. Y.



STEARNS MFG. COMPANY,

ERIE, PA.

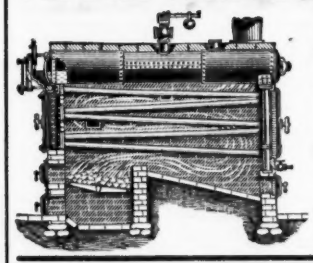
Engines from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user Send for Catalogues.

SAW MILLS and GENERAL MACHINERY.

Works at ERIE, PA.

VAN DYKE WATER-TUBE BOILER.



Cheapest and best boiler in market.

Safety, Economy, Durability.

VAN DYKE MFG. CO.,

60 Greenpoint Ave.

BROOKLYN, N.Y.

DRAWING INSTRUMENTS

Send for 72-Page Illustrated Catalogue.

WM. T. COMSTOCK,

6 ASTOR PLACE, NEW YORK

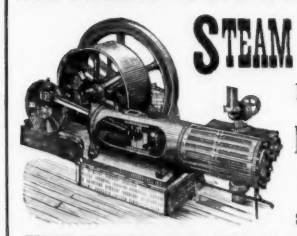
W. C. YOUNG & CO., WORCESTER, MASS.

Manufacturers of

ENGINE LATHES, HAND LATHES,

Foot Power Lathes, Slide Rests, &c.

The Beckett & McDowell Mfg. Co.



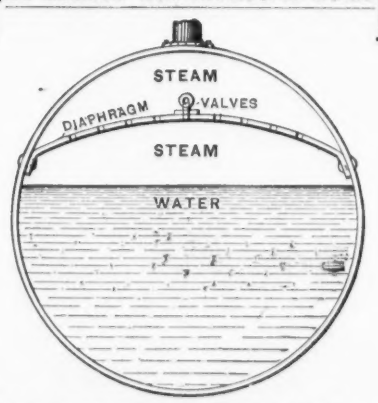
STEAM ENGINES

Hoists, Pumps AND GENERAL Mining Machinery.

120 LIBERTY ST., NEW YORK.

Send for Illus. Catalogue.

THE LAWSON NON-EXPLOSIVE BOILER



This is the only steam boiler ever devised in strict compliance with the demands of natural laws. It gives complete immunity against explosions, delivers dry steam, prevents all incrustation and deposit on the bottom plates, affords safety with high pressure, and secures great economy. The invention is applicable to every style of boiler, and can be readily applied, internally or externally, to new or old boilers. Licenses granted on liberal terms to manufacturers. Send for description.

Lawson Non-Explosive Boiler Co.,

155 & 157 BROADWAY, N. Y.

THE LOWE

Feed Water Heater

AND PURIFIER.

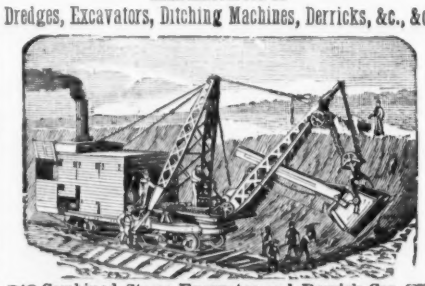
This heater has seamless straight tubes, brass or copper. No necessity for bent or bowed tubes, because construction provides for the differential expansion between shell and tubes. Adapted for high or low pressure engines. Saving in fuel and boiler repairs guaranteed. Least back pressure on engine. Reliable water purifier; the highest results obtained from exhaust steam. Write for "History of Feed Water Heaters," free on application, to William Lowe, Patentee and Sole Manufacturer, Bridgeport Boiler Works, Bridgeport, Conn., or to L. M. Moyes, Gen'l Sales Agent, 37 Dey Street, New York.

OSGOOD DREDGE CO., ALBANY, N. Y.

RALPH R. OSGOOD, Pres. JAMES H. BLESSING, Vice-Pres.
JOHN K. HOWE, Secretary and Treasurer.

Manufacturers of

Dredges, Excavators, Ditching Machines, Derricks, &c., &c.

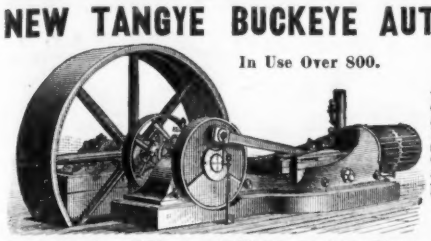


Combined Steam Excavator and Derrick Car.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use Over 800.

25 to 1000 H. P.



These Engines are the combined result of long experience with automatic cut-off regulation and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-Contained Automatic Cut-Off Engines, 12 to 100 H.P. for driving Dynamo Machines a SPECIALTY.—Illustrated Circulars with various data as to practical Steam Engine Construction and performance, free by mail. Address

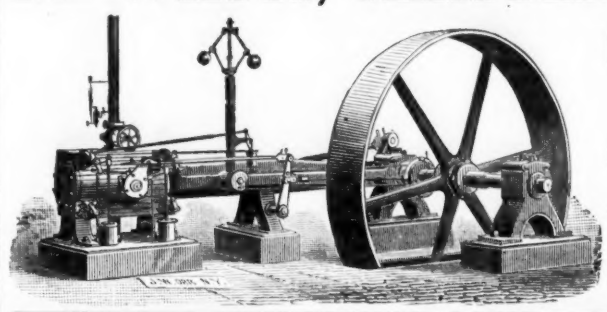
BUCKEYE ENGINE CO., Salem, O.

Sales Agents: GEO. A. BARNARD, 70 Astor House, N. Y., and 53 Mason Building, Boston, Mass. | D. L. DAVIS, 23 S. Canal St., Chicago, Ill., and ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, Limited, Philadelphia.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland, and Virginia.

THE WATTS, CAMPBELL CO., NEWARK, N. J.



MANUFACTURERS OF

Improved Corliss Steam Engines.

IN FULL VARIETY.

Sizes varying from 30 to 2000 H.P.

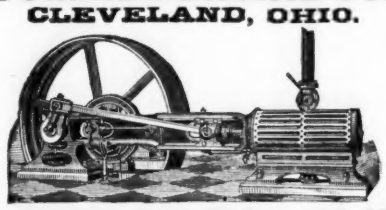
Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound. Send for Circular.

BRANCH OFFICE:

Cor. 5th and Chestnut Sts., PHILADELPHIA, PA.

CUMMER ENGINE CO.

CLEVELAND, OHIO.



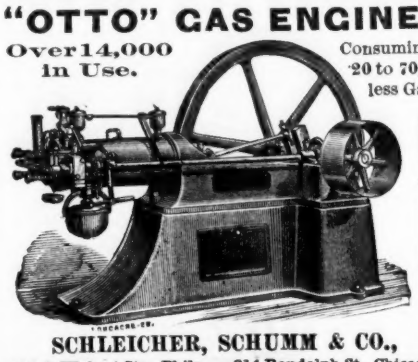
Awarded Gold Medals and All Highest Premiums for BEST AUTOMATIC ENGINE at both Cincinnati and Louisville in 1883.

Send for 150 Page Illustrated Catalogue.

"OTTO" GAS ENGINE.

Over 14,000 in Use.

Consuming 20 to 70% less Gas than any other engine.



SCHLEICHER, SCHUMM & CO.,

33d & Walnut Sts., Phila. 214 Randolph St., Chicago.

AUTOMATIC CUT-OFF ENGINE

Embodying a New System of Regulation.

The Governor Weighs the Load.

Send for Circular A

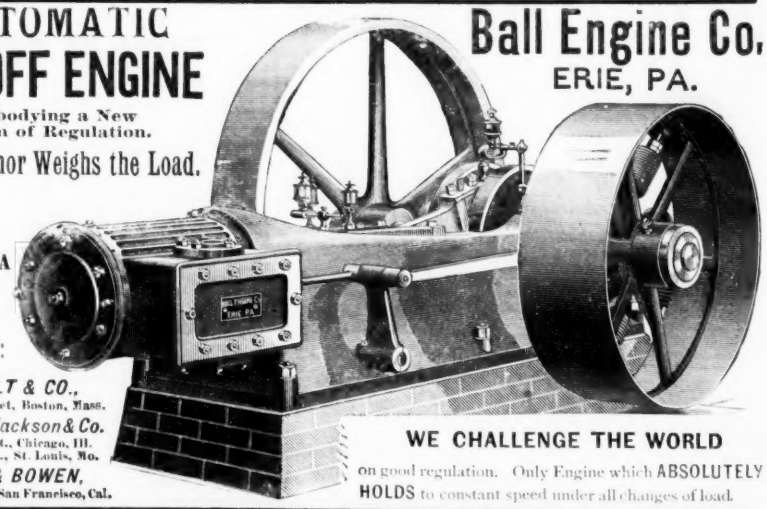
GENERAL AGENTS:

S. L. HOLT & CO., 67 Sudbury Street, Boston, Mass.

Kingsland, Jackson & Co. 28 So. Canal St., Chicago, Ill. 823 North 2d St., St. Louis, Mo.

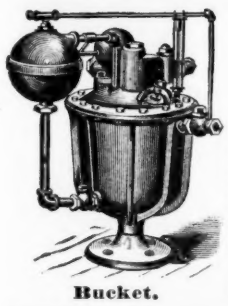
TATUM & BOWEN, Portland, Ore. San Francisco, Cal.

Ball Engine Co. ERIE, PA.



WE CHALLENGE THE WORLD on good regulation. Only Engine which ABSOLUTELY HOLDS to constant speed under all changes of load.

THE ALBANY STEAM-TRAP CO.'S BUCKET AND GRAVITATING T·R·A·P·S

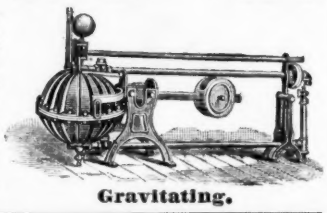


Bucket.

Automatically drain the water of condensation from HEATING COILS and return it to the boilers whether the coils are above or below the water level in boiler, doing away with pumps and other mechanical devices for such purposes.

We also manufacture Blessing's Patent Renewable-Seat Stop and Check Valves.—Send for Circular.

Albany Steam-Trap Co. Albany, N. Y.



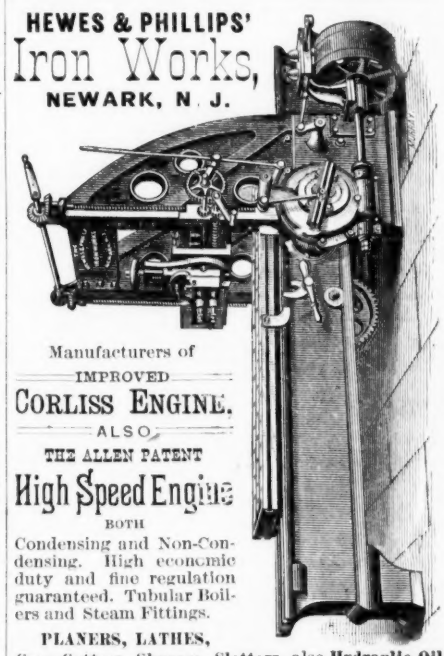
Gravitating.

SPECIAL TOOLS FOR RAILWAY REPAIR SHOPS

L. B. Flanders Machine Works,

PEDRICK & AYER, Proprietors. PHILADELPHIA, PA.

HEWES & PHILLIPS' Iron Works, NEWARK, N. J.



Manufacturers of IMPROVED CORLISS ENGINE.

ALSO THE ALLEN PATENT High Speed Engine BOTH

Condensing and Non-Condensing. High economic duty and fine regulation guaranteed. Tubular Boilers and Steam Fittings.

PLANERS, LATHES, Gear Cutters, Shapers, Slotters, also Hydraulic Oil Presses, and Veneer Cutting Machinery, SHAFTING and GEARING.

HEAVY PLANERS A SPECIALTY.

BOILERS, GAS HOLDERS, GAS GENERATORS,

BUILDERS OF

WARDEN & MITCHELL,

Germantown Junc., Philadelphia.

Hydraulic Riveting Plant and full facilities.

TANKS, STILLS, BRIDGES, ETC., ETC.

BLUE PROCESS PAPER —HELIOS—

In Sheets and in Rolls. Prepared and Unprepared. The best article for copying Drawings.

PARAGON & DUPLEX DRAWING PAPER.

Union Tracing Cloth,

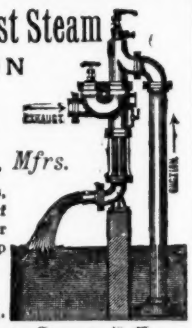
MATHEMATICAL INSTRUMENTS, COLORS & BRUSHES,

In largest variety. Send for Circular.

KEUFFEL & ESSER. NEW YORK.

The Korting Exhaust Steam INDUCTION CONDENSER.

L. SCHUTTE & CO., Mfrs.



For Steam Engines and Pumps. Utilizes the remaining energy of the exhaust steam whether under suction or fall of water. No Pump required.

Offices and Warerooms: 12th and Thompson Streets, Phila.

A. ALLER, 109 Liberty Street, N. Y

JARVIS ENG. CO., 7 Oliver St., Boston

SELDEN'S ★PATENT★ PACKINGS.

Recommended by Leading Engineers for Steam and Hydraulic Use.

Made either *with* or *without Rubber Core.*

RANDOLPH BRANDT, 38 Cortlandt St., New York.

ESTABLISHED 1866

Buerk's Watchman's Clock. with Safety Lock Attachment 20 PRIZE MEDALS AWARDED.

To control watchmen in manufacturing establishments, public buildings, warehouses, etc. Simplest, strongest, cheapest and most complete of its kind. Price, with 12 keys, complete, $50. Send for Circular.

O. E. HAUSBURG, Sole Agent, 71 NASSAU ST., Room 3, N. Y.

FOR SALE

THE FOLLOWING

Second-Hand Machine Tools,

all in good order, and ready for immediate delivery:

One Engine Lathe, 42″x14′ triple geared.			Niles Tool Works.
One	ea.	38″x15′6″ and 17′6″ bed.	Pond.
One	"	28″x17′6″	" "
One	"	26″x12′ bed.	Niles Tool Works.
One	"	24′x10′ and 12′ bed.	Pond.
One	"	20″x6′8″10′ and 12′6″ "	"
One	"	18″x9′	" "
One	"	16″x7′ 8′ 10′ bed.	Bridgeport Mach. Tool Works.

One 8″x 9″ Vertical Engine, N. Y. S. S. P. Co.
One Suspension Drill.

For further particulars, prices, &c., write to

S. S. HEPWORTH & CO.

"Glenwood Station," YONKERS, N. Y.

DROP FORGINGS OF IRON OR STEEL

BEECHER & PECK, NEW HAVEN CONN.

PECK'S PAT. DROP PRESS.

NEW HAVEN BEECHER & PECK, CONN.

SECOND-HAND IRON WORKING MACHINERY

16 in. x 6 ft. Engine Lathe. Ames. Good order.
16 in. x 6 ft. " Harrington. Good order.
20 in. x 7 ft. " Ames.
20 in. x 8 ft. " Harrington. "
24 in. x 10 ft. " Ames.
52 in. x 26 ft. " Bement. Good order.
46 in. Raised to swing.
30x28 ft. Shafting Lathe. New Haven. Nearly new.
22x38 in. x12 Extension Lathe. Harrington.
One Brass Lathe with Chasing Bar. Cheap.
One 12 in Stroke Crank Planer. Belden.
20 in. x 4 ft. Planer. New Haven.
18 in. x 3ft. Planer. Wheeler.
30 in. x 8 ft. " Pond.
36 in. x 12 ft. " Niles. Nearly new.
42 in x 12 ft. " N. Y. S. E. Co. Good order.
One 15 in. Shaper. Hendey.
10 in. Stroke Slotter. Hewes & Phillips
One Universal Miller. Brown & Sharpe.
One Milling Machine. Each Poole & Brainard.
One Milling Machine. No. 2 Garvin.
Four No. 2 Miller. P. & W. Lincoln Pattern. N'ly new.
One No. 1 Miller. P. & W. Nearly new.
One No. 1 Miller. Hand. P. & W. Nearly new.
One No. 2 Screw Machine. " " "
One 20 in. Drill. Prentice. " "
One 30 in. Drill. Putnam. Good order.
One Horizontal Boring and Drilling Mach. Ames.
No. 1 1-Spindle Drill. Smith & Garvin.
One Profiling Machine. Garvin 1 spindle.
One No. 4 Stiles Punch Press. New

We have a full line of new m'ch'y, and are prepared to make low quotations. Agent for the following firms. Write full particulars of what is wanted.

NEW YORK AGENT FOR

Brown & Sharpe Manufacturing Co.
Powell Machine Tool Co.
Bradley's Cushion Hammer.
National Mchy. Co. Bolt and Nut Mchy.
Hilles & Jones, Boiler Tools.
Slates Sensitive Drills.
Elliott's Drills. Gage Brass Lathes.

E. P. BULLARD, 14 Dey St., NEW YORK.

IRON-WORKING MACHINERY

NEW.

1 Engine Lathe, each 10, 11, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 28, 30, 36, 42 and 48 in. swing; length of bed to suit.
1 Fox Turret Lathe, each 13, 15 and 16 in. swing; 5 ft. bed.
1 Sq. Arbor Fox Lathe, 15 in. x 6 ft.
1 each, Hand Lathes, 10, 12, 14, 15 and 18 in. swing.
1 Iron Planer, each to plane 18, 20, 22, 24, 26, 30 and 36 in. wide and high; length of table to suit.
1 each, 16, 20, 22, 23, 25, 28, 30, 34, 38 and 42 in. swing Upright Drills.
1 each, 2, 3, 4 and 6 Spindle Gang Drills.
1 each, 8, 10, 12, 15, 20 and 28 in. Shapers.
1 No. 2 Milling Machine, Lincoln pattern.
1 Grant & Bogert Milling Machine.
1 each, Nos. 2, 4 and 5 Screw Machines.
1 each, 3 and 7 Spindle Nut Tapper.
1 Boring and Turning Mill, each 50 and 72 in. swing.
1 Cutter Grinder.
1 12 in. x 24 in. Cylinder Horizontal Engine.
1 each 4, 5, and 6 ft. Arm Universal Radial Drills.
1 Pat. Makers Lathe, 25 in. x 12 ft. between centers.
1 Grant's New Universal Miller.
1 Pr. Bending Rolls for ⅝ in. x 60 in. plates.

SECOND-HAND.

1 Engine Lathe, each 18 in. x 8ft. Good as new.
1 " " 22 x 10 ft. A1 order.
1 Iron Planer, 20 x 20 x 4 ft. A1 order.
1 " " 24 x 24 x 5 ft. " "
1 " " 30 x 30 x 7 ft. " "
1 " " 32 x 30 x 9 ft. " "
1 40 lb. Bradley Hammer.
1 Lincoln Pattern No. 2 Miller.
1 36 in. Gear Cutter.
1 Horizontal Boring Machine; takes 6 ft. between centers; 36 in. swing.

All Kinds Machinist's Tools and Supplies.

NEW YORK AGENCY OF THE TANITE CO., TAYLOR MFG. CO., ENGINES, BOILERS, &c., AND FOR THE NEW POLISHED SHAFTING.

H. PRENTISS & CO., 42 Dey St., N. Y.

GEORGE H. BENJAMIN, Electrical and Mechanical Engineer,

Expert in Patent Causes and Solicitor of American and Foreign Patents.

234 BROADWAY, NEW YORK.

FOR SALE

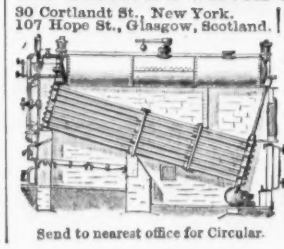
The following extra heavy machine tools:

1 8′x8′x16′ Planer. Double Head with 1 interchangeable Side Head.
1 48″ swing x14′ Forge and Roll Turning Lathe.
1 36″ " x16′ " " " " "
1 Double Column Universal Drill Press. Two Heads. Above Tools all new and for immediate delivery.

Hewes & Phillips Iron Works, Newark, N. J.

THE BABCOCK & WILCOX CO. —WATER TUBE STEAM BOILERS.

30 Cortlandt St., New York.
107 Hope St., Glasgow, Scotland.



Send to nearest office for Circular.

Branch Offices.
BOSTON: 50 Oliver Street.
PHILADELPHIA: 32 N. 5th Street.
PITTSBURGH: 98 4th Avenue.
CHICAGO: 64 S. Canal Street.
CINCINNATI: 64 W. 2d Street.
NEW ORLEANS: 54 Carondelet St.
SAN FRANCISCO: 561 Mission Street.
HAVANA: 50 San Ignacio.

SECOND-HAND MACHINERY FOR SALE.

One Engine Lathe, 87 in. swing, 20ft. bed. Comp'd rest. Screw feed geared in face plate.
One Engine Lathe, 78 in. swing, 14 ft. bed. Comp'd rest. Screw feed geared in face plate.
One Engine Lathe, 20 ft. bed, 42 in. swing.
One Engine Lathe, 16 ft. bed, 48 in. swing. Bement's make.
One Engine Lathe, 12 ft. bed, 25 in. swing. Bement's make.
One Iron Planer, planes 34 ft. long, 72 in. wide. Very heavy.
One Iron Planer, planes 24 ft. long, 62 in. x 62 in. Excellent condition.
One Iron Planer, planes 16 ft. long, 42 in. x 42 in Bement's make.
One Iron Planer, planes 11 ft. long, 36 in. x 36 in. Bement's make.
One Iron Planer, planes 8 ft. long, 30 in. x 30 in.
One Iron Planer, planes 7 ft. long, 30 in. x 30 in. New Haven make.
One Iron Planer, planes 6 ft. long, 28 in. x 28 in. Halliday make.
One 5-foot Radial Drill. Bement's make.
One 40-inch B. G. S. F. Upright Drill. N. Y. Steam Engine Co.'s make.
One 42-inch Car-Wheel Borer. Bement's make.
One 12-inch Slotting Machine.
One Axle Lathe.
Two Durrell's 7-Spindle Nut Tappers.
Send for lists New and Second-hand Tools, too long for publication

THE GEORGE PLACE MACHINERY CO.,

121 Chambers & 103 Reade Sts.,

NEW YORK.

Important Improvement
IN
Graduated SCALES.

The undersigned have the pleasure of informing mechanics, and others interested in fine measurements, that they have made an improvement in the graduation of their rules, by which measurements can be readily made and dividers set by thousandths of an inch. The improvement consists in making in a scale of hundreths, (perfectly near the end,) nine spaces of eleven-thousandths (11-1000) of an inch each and a diagonal line of points or dots, the point nearest the edge of the rule being twelve thousandths from the last line, the second point thirteen-thousandths, and so on, each point being one-thousandth of an inch further from the line than the point preceding it.

By the addition of the nine (11-1000) spaces, measurements can be made and dividers set by thousandths of an inch, from one-tenth of an inch to any length on the scale of hundredths; and with the addition of the nine (11-1000) spaces and line of points, dividers can be set by thousandths, from one-hundreth of an inch to any part of the scale.

Examples: To set dividers thirteen-thousandths of an inch, place one point of the dividers in the second dot and the other point in the last line. To get 75-1000, take two hundreths and five of the (11-1000) spaces. To get one inch and one thousandth, take ninety-nine hundreths and one of the (11-1000) spaces. To get 575-1000, take fifty-two hundreths and five of the (11-1000) spaces.

Believing this device to be of great convenience, and much needed in the present advanced state of the mechanic arts, we have added it to all lengths of our scales without additional charge.

DARLING, BROWN & SHARPE,

February 18, 1885. Providence, R. I.

REMOVAL

On or about the 1st of April, 1885,

THE

Eastern Warerooms OF THE Niles Tool Works,

REPRESENTING ALSO

The Gordon & Maxwell Co. HAMILTON, OHIO. | The Morgan Engineering Co. ALLIANCE, OHIO.

will move their offices and stock of machinery to the very commodious premises

No. 713 CHESTNUT STREET, PHILADELPHIA, PA.,

where they will be pleased to see their friends.

WESTON'S PATENT POWER TRAVELING CRANES

OF ANY CAPACITY.

Particulars on application, and full specification and tender promptly submitted on receipt of capacity and span of bridge desired.

SOLE MAKERS:

The Yale & Towne M'f'g Co.,

STAMFORD, CONN.

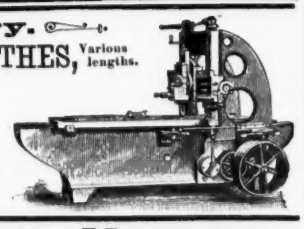
NEW YORK, 62 Reade Street. | CHICAGO, 64 Lake Street.
BOSTON, 224 Franklin Street. | PHILADELPHIA, 15 N. Sixth Street.

GENERAL CRANE CATALOGUES ON APPLICATION.

For Immediate Delivery.

30 in. x 30 in. PLANERS, to plane 6 ft. and 9 ft. long, also 19 in. LATHES, Various lengths.

GREAT REDUCTION IN PRICES.



G. A. GRAY, Jr. & CO.,
42 EAST EIGHTH STREET,
Cincinnati, O.

E. GOULD & EBERHARDT,
NEWARK, N. J.

Pat. Universal Automatic Gear Cutter.

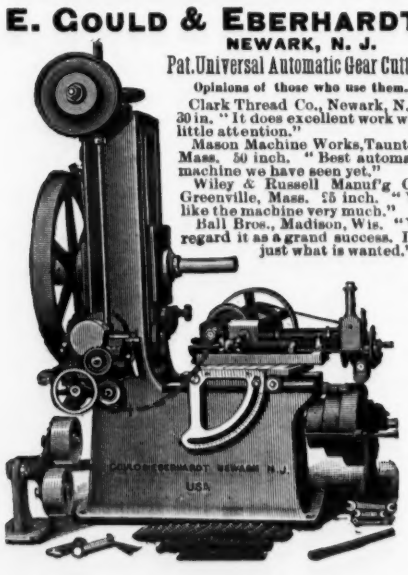
Opinions of those who use them.

Clark Thread Co., Newark, N. J. 30 in. "It does excellent work with little attention."

Mason Machine Works, Taunton, Mass. 50 inch. "Best automatic machine we have seen yet."

Wiley & Russell Manuf'g Co., Greenville, Mass. 25 inch. "We like the machine very much."

Ball Bros., Madison, Wis. "We regard it as a grand success. It is just what is wanted."



MILLING MACHINES
In seventeen regular and nine special varieties and sizes.

DRILL PRESSES,
Ten regular and eleven special sizes.

SENSITIVE DRILL PRESSES,
Two, three, four or more spindles.

TAPPING MACHINES,
Four Varieties.

HAND LATHES,
Eight, ten, twelve and fifteen inch swing, with or without back gears.

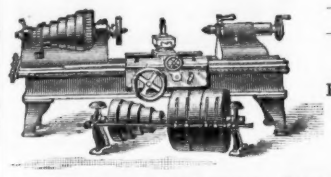
CUTTER GRINDERS,

WOOD PLANERS, SLIDE RESTS
AND
SPECIAL MACHINERY
Of Every Description.

If in want of anything in the machinery line write for catalogue, stating what you want, to

E. E. GARVIN & CO., 139 to 143 CENTRE ST., NEW YORK.

THE PRATT & WHITNEY CO.,
HARTFORD, CONN.,



Manufacture **LATHES** of Various Sizes

AND OF THE FOLLOWING KINDS:

HAND, ENGINE FOR TURNING AND SCREW CUTTING, CUTTING OFF, GAP BED, PULLEY TURNING AND BORING, TURRET-HEAD ENGINE AND CHUCKING, HAND WHEEL, RIM TURNING, SPINNING, GRINDING, PATTERN MAKING, &c.

Price List and Description Given upon Application.

HARTFORD, | **THE BILLINGS & SPENCER CO.** | CT., U. S. A.

MANUFACTURERS OF

Billings' Bicycle Pocket Wrench, 4 & 6 in. long.

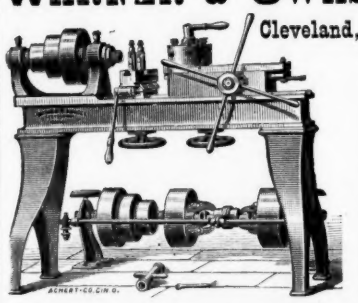
Drop forged of Bar Steel.

First-class in every respect.

DROP FORGINGS of EVERY DESCRIPTION.

Estimates given on receipt of drawing or model.

WARNER & SWASEY,
Cleveland, Ohio.



BRASS WORKING MACHINERY.

Illustrated Catalogue on Application.

GEO. W. FIFIELD,

Manufacturer of ENGINE LATHES from 15 to 48 in. swing. Cuts, Photographs and Prices furnished on application. Lowell, Mass., U. S. A.

GEAR WHEELS and GEAR CUTTING.

Gears cut or made to order. Of every kind, spur, bevel, worm, rack, ratchet, internal, etc. Of any size, from a quarter-inch to six feet diameter. In any material. In any quantity. Small gears on hand for free delivery by mail. Send for illustrated price list.

GEO. B. GRANT, 66 Beverly St., Boston.

DAVIS PATENT KEY SEATER & DRILLS

SEND FOR CATALOGUE TO W. P. DAVIS NORTH BLOOMFIELD N.Y.

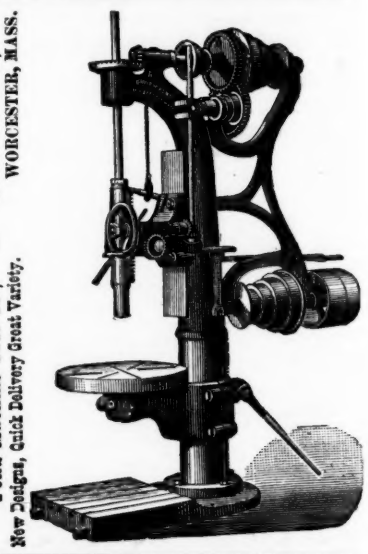
A Key Seat Machine will save enough in sixty days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment, both Key Seat Machines and 20 in. Drills. Send for Photo. and Catalogue.

W. P. DAVIS, North Bloomfield, N.Y.

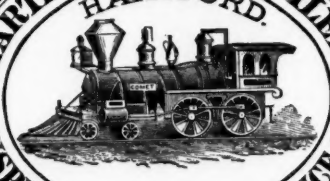
Engine Lathes, Planers, Drills, &c.

Successors to **David W. Pond,** WORCESTER, MASS.

New Designs, Quick Delivery, Great Variety.



HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.



J. M. ALLEN, President.
W. B. FRANKLIN, Vice-President.
J. B. Pierce, Secretary.

PUNCHING PRESSES,

ROP HAMMERS

Dies and other Tools for the manufacture of all kinds of SHEET METAL GOODS, Drop Forgings, &c.

Stiles & Parker Press Co., Middletown, Conn.

BRANCH FACTORY AND OFFICE, 59 DUANE STREET, N. Y.

THE BUFFALO STEEL FOUNDRY, BUFFALO, N. Y.

ORDERS AND CORRESPONDENCE SOLICITED. | PRATT & LETCHWORTH, Proprietors.

LODGE, BARKER & CO.,
Cincinnati, Ohio.

Manufacturers of IRON and BRASS WORKING MACHINERY

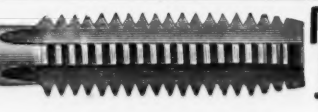
Monitor Turret Lathes with Chasing Bar. These lathes chase right and left hand threads without changing leaders, thus saving expenses. The center of holes in turret is high enough from top of plate to enable dies or box tools of 5 inches diameter clear around. Have side and end motion lever and screw, also swivel. Are first-class in every particular.

Round and Square Arbor Lathes of 12 in. and 14 in. swing with side motion and chasing bar and without back gear for ELECTRICAL and other light work at reasonable figures.

Write us for Prices, it will pay you.

Box Chucks, Valve Millers, Speed Lathes, &c., &c.

J. M. CARPENTER
PAWTUCKET, R. I.



MANUFACTURER —OF— TAPS AND DIES